ANNUAL REPORT

OF THE

SECRETARY OF THE NAVY

ON THE

OPERATIONS OF THE DEPARTMENT

FOR

THE YEAR 1878,

WITH

ACCOMPANYING PAPERS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1878.

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REPORT

OF

THE SECRETARY OF THE NAVY.

WASHINGTON CITY, D. C.,
Navy Department, November 30, 1878.

SIR: I have the honor to lay before you the regular annual report of the condition and operations of the Navy Department, including the expenditures of the last and the estimates for the next fiscal year.

Since the last annual report the condition of the Navy has been considerably improved. There are now in commission 28 cruising-ships, 1 steamboat, and 5 sailing-vessels, making 34 in all. These are in condition for active service, except the Gettysburg, now in the Mediterranean squadron, which, in consequence of deterioration in her iron plating and the recent breaking of a shaft, will probably require more repairs than it would be good economy to make. This will reduce the number to 33 now in commission as cruisers and needing no immediate repairs.

There are 6 vessels, including 1 monitor, recently put out of commission for repairs, all of which can be made ready for sea again in the course of a few months. The work will be done with all possible dispatch. Besides these, there are 13 needing repairs somewhat more extensive and which it will require more time to make. But the whole of these 19 vessels can be repaired and put also in thorough condition with the present appropriations and those asked for the next fiscal year, and, therefore, without any additional charge upon the Treasury. That is, if the same appropriations shall be made for the next fiscal year as have been made for the present, the department will be enabled to make the necessary repairs upon all these vessels, so that the number of cruisers will be to that extent increased. When this is accomplished the effective cruising force of the Navy will be 47 steam and 5 sailing ships, making the total number 52.

The number of monitors now ready for service is 13, and as the one recently put out of commission can be soon repaired, and the Miantonomoh can be completed out of existing appropriations, the number may be properly fixed at 15. Two torpedo-boats are now also ready for service.

It will be seen, therefore, that without any increase of appropriations beyond what is asked for—that is, within the means under the control of the department with the current appropriations—the total fighting

force of the Navy will be 51 cruising-ships, 15 monitors, and 2 torpedo-boats, making in all 68.

But this does not show the whole naval force that could be put in service in case of necessity. The 4 double-turreted monitors and 1 single-turreted now in progress—the Puritan, Amphitrite, Monadnock, Dictator, and Terror—could be completed without much delay, with the necessary appropriations for that purpose. Six cruising-ships, upon which repairs are not at present contemplated—the Colorado, Wabash, Franklin, Florida, Minnesota, and New York—could be soon put in condition as fighting-ships if necessity required it. And this being done, the fighting force of the Navy would be 57 cruising-ships, 20 monitors, and 2 torpedo-boats, to which could be added, in case of imminent necessity, 2 other steam and 2 sailing vessels, thus making the total number 83. The number might still be increased, however, by utilizing 8 large iron tugs, of over 300 tons each, now at navy-yards and other stations, which could be converted into gun or torpedo boats, and thus make the whole number of war-vessels of all classes 91.

There are 32 steam and sailing vessels now unfit for use for warlike purposes, although 4 of these might, if necessity demanded, be put in condition for temporary service at sea. Of these, 4 have been in use nearly 60 years, having been built before the year 1820, and 15 were built before the war, leaving 14 only that have been built and 2 that were purchased since the beginning of the war. Of those built during the war, 10 were constructed with great rapidity and under the pressure of the most urgent necessity, and consequently out of timber not sufficiently seasoned to insure their durability, even to the average life of other vessels. Their decay, therefore, has been unavoidably rapid. And as it would not be good economy to undertake the repair of vessels so far decayed as the greater part of these now are, it would be better that they should be sold or broken up, and authority conferred upon the department to use the proceeds for the repair of such other vessels as may need them, so as to keep the Navy in its present condition of efficiency, as nearly as possible, without additional drafts upon the Treasury. To this number of vessels unfit for fighting purposes may be added 4 iron-clads, which should also be disposed of in the same way. If, then, there should be added to the fund thus produced the proceeds of the sales of waste material, the business of the department would be greatly facilitated without new appropriations.

SQUADRONS.

The EUROPEAN SQUADRON remains under the command of Rear-Admiral William E. Le Roy. Of the ships which composed it, the Gettysburg is much out of repair, and has recently broke a shaft in the Mediterranean. It is deemed impracticable, in consequence of her condition, to attempt a voyage across the Atlantic with her at this time, and it may ultimately become necessary to dispose of her in Europe, if

it shall be found that she could not be economically repaired. The terms of enlistment of the crews of the Vandalia and Marion are about to expire, and they have been ordered home, to be supplied with new crews. Upon this being done they will be disposed of as necessity may require. The Wyoming and Enterprise have been ordered to take their places, and the Quinnebaug will also be sent to this squadron so soon as she has been sufficiently tried to assure her fitness for sea duty. With these exceptions, this squadron remains as at the date of the last report.

The ASIATIC SQUADRON is still under the command of Rear-Admiral Thomas H. Patterson. Since the last report the Kearsarge and the Tennessee have reached home, their cruises having expired, and are both now undergoing repairs, and will soon be ready for sea again. The Monongahela and the Richmond will take their places, the former having already reached there, and the latter being now nearly ready to sail. The squadron, with these exceptions, remains unchanged.

The NORTH ATLANTIC SQUADRON is now under the command of Rear-Admiral John C. Howell. Of the ships in this squadron at the last report the Enterprise has been withdrawn for service in the Mediterranean, and the Ossipee and the Swatara are now awaiting repairs. Upon their completion they will remain in this squadron, and the Shenandoah, Wachusett, and Kearsarge, when ready for sea, will be added to it. In order that the effective naval force of this squadron may be appreciated, it should be observed that the following monitors are in condition to be employed at any time to protect the ports on the Atlantic coast, to wit: The Ajax, Catskill, Jason, Lehigh, Mahopac, Manhattan, Montauk, Nahant, Nantucket, Passaic, Wyandotte, and the Canonicus, now at New Orleans. Besides these, the torpedo-boats Intrepid and Alarm are in commission, the former at New York and the latter at Washington.

THE SOUTH ATLANTIC SQUADRON remains as at the date of the last report. But as the Nipsic, Galena, and Juniata will be ready for sea during the year, it is contemplated to send one of them to this squadron, and to hold the others for assignment wheresoever the necessities of the service may indicate.

THE NORTH AND SOUTH PACIFIC SQUADRONS have been united and placed under the command of Rear-Admiral C. R. P. Rodgers. The two squadrons consisted of five vessels at the date of the last report. Since then the Omaha has been withdrawn, and is now condemned as unworthy of repair in consequence of decay. The Pensacola and Lackawanna have both been repaired and are now at sea in good condition. The Alaska has been sent out to take the place of the Omaha, and the Tuscarora is added to this squadron. The Onward, which is not in good condition, remains as a storeship at Callao, in Peru. Besides these, the monitor Comanche is attached to this squadron, and the Iroquois, now undergoing repairs at Mare Island, will, when completed, be also attached to it.

The ships not embraced by assignments to these squadrons are as follows: The Ticonderoga, Franklin, Vandalia, Marion, Constellation, Constitution, Portsmouth, Saratoga, Guard, Tallapoosa, and Michigan. The Vandalia and Marion, upon their return, will be refitted for sea immediately. The Constellation remains in service at the Naval Academy. The Constitution and Portsmouth are at Havre, France, in attendance upon the Paris Exposition, and will return home in December. The Saratoga has been fully repaired, and is used as a training-ship. The Franklin is still a receiving-ship. The Guard has just returned home and will need repairs. The Tallapoosa is engaged as a transport-vessel between the navy-yards on the Atlantic.

The Ticonderoga has been detailed, under the command of Commodore R. W. Shufeldt, for special service upon the coast of Africa and in the East Indian Islands. This service is regarded as especially important in its relations, not merely to international matters confided to it, but to our commercial interests. The officer assigned to this command is peculiarly fitted for the delicate duty confided to him, and the most satisfactory results are expected from his cruise. Besides his other duties, he has been designated to act as a commissioner to adjust a controversy in reference to the boundary-line between the British possessions in Africa and Liberia.

An expedition of a character somewhat kindred to this was fitted out during last summer with the Enterprise, under the command of Commander Thomas O. Selfridge. Realizing the obligation of omitting nothing in its power to open up commercial intercourse between all parts of South America and the United States, the department directed a survey of the Amazon and Madeira Rivers. The importance of these rivers as natural outlets for the internal commerce of that country cannot be overestimated. They connect Bolivia with the Atlantic; and the people of that country are beginning to realize the benefits they will derive from an encouragement of their navigation. A company organized in the United States is now engaged in constructing a railroad around the falls of the Madeira, which, when completed, will enable our merchants to carry on a large and profitable trade with the interior. It was deemed important that, before this trade should be developed, the people of Bolivia should be convinced that it would be to the mutual advantage of both countries if commercial intercourse were established between them and the people of the United States.

The expedition was a success in an eminent degree, and reflects the highest credit upon all the officers who had it in charge and upon the crew of the Enterprise.

The results are both interesting and instructive, and it is hoped that Congress will provide for the publication of the report of Commander Selfridge.

The city of Para has a population of about 30,000 inhabitants, and bears the same relation to the Amazon River that New Orleans does

to the Mississippi. Its trade will continue to increase as the interior of the country is developed, which, under the liberal policy of the Emperor of Brazil, is now assured. The mouth of the Madeira River is 980 miles above the city of Para, and from there to the falls this river is navigable for steamers of ten feet draught a distance of 1,000 miles. The falls are about 300 miles in length, and when the railroad is completed and the difficulty of passing them removed, easy access to the large rivers which flow through Bolivia will be had. The Amazon is a river of extraordinary dimensions, and a line-of-battle ship can easily ascend it for 1,500 miles from the sea. At a distance of 900 miles from its mouth it has a depth of 50 fathoms. As there is no difficulty about the navigation of this great river, this survey will serve to show its dimensions, and the maps of the Madeira will enable steamers to ascend it at the periods of safe navigation, without relying upon local pilots. It is confidently expected that the most beneficial results will follow this expedition and report.

The Michigan has been employed for a number of years upon the northern lakes. The question whether or no the arrangement of April 28, 1817, in reference to the naval forces of Great Britain and the United States on the lakes remains still in force or has been terminated by the joint resolution of Congress approved February 9, 1865, must rest upon the decision of Congress. The diplomatic engagements between the two governments since the passage of the joint resolution have been considered directory to the department, and in consequence the Michigan has been kept in commission and continued in the service for which she was designed. The vessel is now very much out of repair, and requires extensive work to be done upon her in order to keep her in condition for service. If the obligation of 1817 remains in force, this would require a large expenditure of money, and it would probably be more economical to sell her, and apply the proceeds, as far as they would go, to building a new ship for this special service. These questions are respectfully submitted to Congress.

ESTIMATES.

The appropriations of the present year having been thus far, like those of the last, applied to the ordinary expenses of the service and to such repairs of vessels as are absolutely necessary, and it having been found that they are sufficient for this purpose, the department has not felt itself justified in going beyond them in the estimates for the next fiscal year. These estimates are shown by the following table:

Pay of the Navy	$7,350,000 00
Pay of civil establishment in navy-yards	189,999 50
Ordnance and Torpedo Corps	273,000 00
Coal, hemp, and equipment	800,000 00
Navigation and navigation supplies	104,500 00
Hydrographic work	46,000 00
Naval Observatory, Nautical Almanac	43,800 00
Repairs and preservation of vessels	1,500,000 00

Steam-machinery, tools, &c	$800,000 00
Provisions for the Navy	1,200,000 00
Repairs of hospitals and laboratories	30,000 00
Surgeons' necessaries and Naval Hospital fund	95,000 00
Contingent expenses of department and bureaus	205,000 00
Naval Academy	186,894 45
Support of Marine Corps	862,378 50
Naval Asylum, Philadelphia	60,809 00
Maintenance of yards and docks	440 000 00
Repairs, &c., of navy-yards	375,000 00
	$14,562,381 45

It will be observed that the total of this amount is $33,949.75 in excess of the appropriations for the present year. This is for the benefit of the Marine Corps and the Naval Academy. The former is made up of amounts necessary on account of the longevity pay of officers and privates, that of officers on the retired list, pay of clerks and messengers, pay to soldiers for clothing undrawn, increase of pay for leader of the band, and commutation of officers' quarters. The latter is made up of amounts necessary for pay of one mechanic on account of enlargement of laboratory, a small increase of pay to the captain of the watch, on account of his having also to perform other duties, an increase for the expenses of the Board of Visitors, and pay of an additional machinist necessary in the department of steam engineering. No part of the excess is on account of the Navy proper.

EXPENDITURES.

The amount of appropriations applicable to the current expenses for the fiscal year ending June 30, 1878, was $14,435,152.30. The actual expenses, exclusive of deficiencies, during that period were $13,306,914.09. Of the unexpended balance on hand June 30, 1878, there remains $501,272.09 to the credit of the Bureaus of Equipment and Recruiting, Yards and Docks, Ordnance, Navigation, Construction and Repair, Steam Engineering, Provisions and Clothing, and Medicine and Surgery.

The appropriations available for the present fiscal year, commencing July 1, 1878, are $14,528,431.70. The whole amount drawn from the Treasury from July 1 to November 1, 1878, is $4,740,544.14; refunded same period, $70,980.75; which deducted from the amount drawn will show the actual expenditure from July 1 to November 1, 1878, to have been $4,669,563.39. Expenditure during the same period last year was $5,190,462.63, showing that of the present year to have been $520,899.24 less than last year.

Exhibit of expenditure chargeable to Navy appropriations, including deficiencies of 1877–'78.

Date.	Drawn.	Refunded.	Expended.
Appropriations for 1877–'78.			
1877.			
July	$1, 584, 059 44	$6, 874 59	$1, 577, 184 85
August	1, 022, 070 04	13, 007 57	1, 009, 062 47
September	1, 344, 384 27	17, 481 61	1, 326, 902 66
October	1, 392, 523 65	115, 211 00	1, 277, 312 65
November	1, 697, 839 59	140, 960 35	1, 556, 879 24
December	1, 955, 456 96	59, 511 17	1, 895, 945 79
1878.			
January	1, 803, 967 66	527, 064 23	1, 276, 903 43
February	1, 053, 471 63	31, 446 89	1, 022, 024 74
March	1, 397, 547 28	161, 132 63	1, 236, 414 65
April	1, 028, 375 60	38, 271 10	990, 104 50
May	1, 006, 108 36	287, 447 93	718, 660 43
June	4, 079, 724 65	498, 727 41	3, 580, 997 24
Total	19, 365, 529 13	1, 897, 136 48	17, 468, 392 65
Appropriations for 1878–'79.			
1878.			
July	1, 185, 781 89		1, 185, 781 89
August	1, 480, 120 70	68, 299 11	1, 411, 821 59
September	1, 051, 405 39	101 37	1, 051, 304 02
October	1, 023, 236 16	2, 580 27	1, 020, 655 89
Total	4, 740, 544 14	70, 980 75	4. 669, 563 39

Exhibit of expenditure chargeable to Navy appropriations, excluding deficiencies of 1877–'78.

Date.	Drawn.	Refunded.	Expended.
Appropriations for 1877–'78.			
1877.			
July	$1, 584, 059 44	$6, 874 59	$1, 577, 184 85
August	1, 022, 070 04	13, 007 57	1, 009, 062 47
September	1, 344, 384 27	17, 481 61	1, 326, 902 66
October	1, 392, 523 65	115, 211 00	1, 277, 312 65
November	1, 559, 464 78	140, 960 35	1, 418, 504 43
December	1, 052, 343 52	59, 511 17	992, 832 35
1878.			
January	1, 329, 244 75	507, 805 13	821, 439 62
February	907, 587 25	26, 667 70	880, 919 55
March	1, 334, 879 32	147, 867 70	1, 187, 011 62
April	996, 873 37	33, 972 67	962, 900 70
May	960, 890 12	279, 749 67	681, 140 45
June	1, 639, 748 55	468, 045 81	1, 171, 702 74
Total	15, 124, 069 06	1, 817, 154 97	13, 306, 914 09

Appropriations for 1878–'79.

1878. July 24. Appropriation warrant No. 316—1879	$14, 092, 622 70
1878. July 30. Appropriation warrant No. 317—1879	375, 000 00
Naval Asylum, Philadelphia—1879	60, 809 00
Total	14, 528, 431 70

From these tables it will be seen that the total expenditures of the last fiscal year, including the amount appropriated for the deficiencies of the previous year, were $17,468,392.65. After deducting these deficiencies, which were $4,161,478.56, the amount chargeable to the expenditures of the year was $13,306,914.09, as stated in the tables, which was $767,199.18 less than the actual expenses of the previous year, and $4,928,677.74 less than the expenditures including the deficiencies of that year, and $4,630,440.63 less than the expenditures of the year ending June 30, 1876.

NAVY PENSION FUND.

The following statement shows the number and yearly amount oi pensions on the rolls June 30, 1878, and the amount paid during the fiscal year:

	On roll June 30, 1878.	Yearly value.	Amount paid for pensions.
Navy invalids	1,781	$200,944 08	$199,981 42
Navy widows and others	1,705	305,290 60	302,989 49
Total	3,486	506,234 68	502,970 91

It will be seen by comparing this statement with that of the last fiscal year that the number of pensioners has increased 47, and that the sum they are entitled to draw has increased $26,576.35, while the total amount actually paid to pensioners has decreased $24,979.64.

This fund was created by the act of April 12, 1800, which organized the Navy. It consists of money accruing from the sales of prizes, which is irrevocably set apart for the payments of pensions to officers, seamen, and marines. And the faith of the government is pledged to make up any deficiency and to devote the surplus, if any, to making provision for the comfort of the beneficiaries. Under the act of March 2, 1831, one-half of all penalties and forfeitures for trespassing on the public timber lands goes to this fund, but the amount derived in this way is very small.

The prize-money constituting this fund is the one-half reserved to the United States after the other half has been distributed among the captors of the prize, and the surplus of this after payments of pensions the Secretary of the Navy is required to invest, semi-annually, in the registered securities of the United States. By this provision the fund would be entitled to an annual interest corresponding with that paid to all the holders of public securities, but another provision of the existing law provides that the interest shall "be at the rate of three per centum per annum in lawful money." Practically, therefore, the provision for investment in public securities is made inoperative by limiting the interest below what any of them bear. It was otherwise when the interest was fixed at six per cent., as it formerly was. Consequently, inasmuch as the obligation of the government, established when the fund was created, remains unimpaired, it is respectfully recommended that the interest be hereafter increased to at least four per cent., so that the investments may be made in bonds of that class. Navy pensioners are entitled, upon the fund withdrawn from their prize-money, to the same interest as that paid to the public creditors.

BUREAUS.

It is due to the bureaus of the department that special attention should be called to their several reports, wherein the details of the work done by them during the year are given. They show an amount which could not

have been accomplished without the utmost watchfulness and care on the part of the officers in charge of these bureaus. And the economy practiced in their disbursements cannot fail to arrest attention. The total balance standing to their credit at the close of the fiscal year ending June 30, 1878, as previously stated, was $501,272.10, made up in favor of each bureau as follows:

Yards and Docks	$40,685 84
Equipment and Recruiting	238,879 20
Navigation	24,750 21
Ordnance	18,586 88
Construction and Repair	37,863 73
Steam Engineering	28,230 09
Provisions and Clothing	102,736 93
Medicine and Surgery	9,539 22
Total	501,272 10

It is also due to the Bureaus of Construction and Repair and Steam Engineering to refer to the amount of work they have respectively done in repairing ships, engines, boilers, &c., all of which is especially set forth in their reports. Seventy-five vessels have been more or less repaired, according to their condition, and ten of them have been thoroughly repaired, together with engines and boilers, and made ready for sea. Two others, the Nipsic and Galena, are in rapid progress toward completion. The machinery of every vessel repaired has been thoroughly overhauled and put in the best condition, and the policy of substituting four-bladed screw-propellers for the various types of two-bladed and patent screws has been initiated. These changes have been attended with the best results, an increased speed of from one to two and a half knots per hour having been obtained, without increase of engine power developed. It is designed to continue these changes until all our vessels are fitted with this type of propeller.

RELATIONS OF THE NAVY TO COMMERCE.

In my last annual report the attention of Congress was directed to the condition of our commerce and the relations borne to it by the Navy. Our rapidly-increasing exports since that time have demonstrated that this country must become the greatest producing country in the world. The area of our improved lands is annually enlarging, keeping pace with our rapidly increasing population and giving assurance that the surplus of our agricultural and manufacturing products will become correspondingly greater every year. Consequent upon this, the skill of our manufacturers, artisans, and laborers will, in the future of our history, be called into still further requisition. And as experience has shown that no nation can afford to leave its commerce unguarded upon the seas, the duty of protecting ours is now greater and more urgent than it has ever been before. This duty is confided to the legislative department of the government, and it would be unjust to assume that, under any exigency of our affairs, it will not be discharged. The American people will not

be likely to accept any condition of things that shall deprive them of those advantages of trade to which their position entitles them; nor is it to be expected that they will be content with any policy that shall put it out of their power to obtain just compensation for their industry and proper reward for their labor.

Not the least of the considerations from which our government derived its existence were the necessities of trade and commerce. In order to avoid conflicting and incompetent regulations by the States, the obligation has been imposed upon the national government to provide for these necessities, not alone by such measures as shall develop our industry to its greatest possible capacity, but by proper maritime protection both at home and upon the high seas. The framers of our institutions were wise enough to know that nations of the largest commerce exercise the greatest influence over the affairs of mankind. With this knowledge to guide them, they constructed the government with reference to this obligation, and conferred upon it such functions as are essential to a just protection of all our industrial interests, with a view to that ultimate commercial supremacy to which, from our geographical position and territorial advantages, we may fairly aspire. And if the government shall fail to do whatsoever it may rightly do to achieve this result, it will be impossible for this country long to maintain its present position in the front rank of nations.

In our earliest legislation in reference to commerce and the regulation of our coasting-trade, preference was given to American over foreign shipping by the exclusion from our registers of all ships built abroad. The degree of protection thus afforded was sufficient to stimulate, not the industry merely, but the ingenuity, of our people, until our registered and enrolled tonnage increased to an extent that threatened the maritime supremacy of Great Britain. For the period of forty years—from 1820 to 1860—American ships carried the average of 81.2 per cent. of the ocean-borne commerce between our own and foreign ports. It was during this period that the vast and unprecedented increase of our shipping took place, rising from 1,280,167 tons in 1820 to 5,353,860 tons in 1860. The decrease in our tonnage and ocean-carrying trade began with the commencement of the war in 1861, and has continued until, during the present year, this large percentage in our favor has been reduced to 26.3 per cent. of freightage; and in the transportation of passengers we retain only 6.7 per cent., whereas we formerly carried nearly all.

Reference to the commerce of the last ten fiscal years, from 1867 to 1877, inclusive, will enable us to realize what we have lost in national wealth from this change. In that period our imports and exports, in the aggregate, amounted to $11,114,174,044, and the number of passengers carried was 4,741,044. The freightage arising from the imports and exports amounted to $889,133,933, and the passage money to $247,971,505, making the total freight and passenger earnings $1,137,105,438. Of this, ships sailing under foreign flags took 70.1 per cent. of the freightage, and

93.3 per cent. of the passage money, leaving to American ships 29.9 per cent. of the freightage and 6.7 of the passage money. These proportions in amount are respectively:

To American ships, freight earnings	$265,851,045 97
To American ships, passage money	16,614,090 85
Total of American portion	282,465,136 04
To foreign ships, freight earnings	$623,282,887 04
To foreign ships, passage money	231,357,414 17
Total portion of foreign ships	$854,639,201 21

These results show that the earnings and profits of this ocean carrying trade have been transposed, and that vessels sailing under foreign flags have now within 2 per cent. of what American vessels had before the war. This is owing, in a great measure, to the increasing use of foreign iron steamships, which have driven nearly all our merchant sailing-vessels from the sea, and with which we cannot successfully compete until our own home industries are stimulated in the same direction. It would seem that our actual loss of $572,174,064 within the ten years, as shown by the foregoing calculation, is sufficient admonition to secure this.

The fiscal year 1878, just closed, shows a further decrease in the rate of our participation in the profits of this carrying-trade from the 29.9 per cent. average to 26.3 per cent. The freightage earnings for that year were $95,200,009, and the passage earnings $21,918,141, making a total of $117,118,150. In all this the participation of American ships was only $26,498,811, while that of foreign ships was $90,719,339.

These are important facts, and cannot fail to arrest the attention of Congress and the country. They show that, at the ratios stated, our farmers, planters, manufacturers, and all others engaged in our numerous industries will, if this condition of things remains unchanged, soon be at the mercy of foreign ship-owners, who will possess the power, because of the absence of competition, to put up their ocean freights to ruinous prices, and thus impose upon our people even heavier and more oppressive burdens than they have hitherto borne. And the fact should not be overlooked that the payment of these immense sums for freights have operated as a drain upon our precious metals. Since the beginning of the war they could not have been paid in legal-tender or national-bank currency, in consequence of the difference in value between it and coin, and consequently, within the ten years from 1867 to 1877, $572,174,064 and during the last fiscal year $90,719,339 in gold, have been taken out of the United States because our mercantile marine has been so reduced that we have not had merchant-vessels enough to retain it by conducting our own carrying trade. It needs no argument to prove that our vari-

ous industries, connected directly and indirectly with commerce, require from the government a greater degree of parental care than this.

We have only to notice the total amount of shipping that entered the United States and cleared thence during the last fiscal year to see the disadvantages under which we labor.

The total number of vessels that entered as foreign was 30,796, representing 14,463,804 tons. Of this number, 15,330 were British vessels, representing 7,732,870 tons, and 10,594 were American vessels, representing 3,642,017 tons. The total number of clearances of vessels as foreign was 31,364, representing 14,807,531 tons. Of this number, 15,351 were British vessels, representing 8,282,348 tons, and 10,872 were American, representing 3,872,203 tons; while French vessels represented 221,362 tons, and those of all other countries 2,431,618 tons. Of the total tonnage entered, 25.1 per cent. was American, 53.4 per cent. British, and 74.9 per cent. was foreign. Of the total tonnage cleared foreign, 26.1 per cent. was American, 55.9 per cent. was British, and 73.9 was foreign.

The total tonnage engaged in the direct trade with Great Britain alone was: Entered, 4,929,834 tons; cleared, 5,891,527 tons; total, 10.821,361 tons. Of this total, 999,277 tons, or 9.21 per cent., was American, and 7,192,089 tons, or 66.46 per cent., was British.

We cannot afford to continue our dependence upon foreign nations for the transportation of our surplus products to the markets of the world. The benefits and profits of our own carrying trade should be enjoyed by our own people, and they cannot be further deprived of them without violating the principles of correct practical economy. Every dollar paid for freights to vessels built and owned abroad is so much coin withdrawn from our own domestic use and added to the wealth of other countries. And when ocean freights are increased, as they have been, beyond their actual value, in consequence of the absence of competition, this burden upon our industry becomes proportionately greater. Only a few years ago a combination of English steamship companies secured almost a complete monopoly of our grain-carrying trade by chartering all the ships available for that purpose, which resulted in an advance of freights upon grain of about 17 cents per bushel, so that the increase alone amounted in the aggregate to about $8,000,000 annually, which was a clear loss to the wheat producers of this country. This large sum would have been saved to us if our own merchant-vessels had not been driven from the sea. The total loss by these means in the shipment of wheat, corn, flour, and cotton was about $18,000,000 annually. And if to this be added the like proportion of loss upon the freights of the other numerous articles which made up the aggregate of our commerce, our annual loss in this excess alone was almost beyond computation.

The effect of competition upon the price of ocean freights is seen at the present time by a comparison of the amounts paid for shipments of wheat from San Francisco and New York to Europe. The large product

of the late harvest in California has attracted so many freighting vessels to the Pacific that prices are greatly reduced, while, in consequence of the diminished number engaged in the Atlantic trade, the old rates from New York to Europe are maintained, or, if changed, are somewhat increased on account of the absence of competition. And the result is that the California wheat-growers get their grain to a European market at only a small fraction more for transportation than those in the Atlantic States, although they have five or six thousand miles more of ocean navigation.

If it is to become a part of our settled policy that our commercial marine shall remain in this condition of inferiority upon the ocean, and this drain upon our wealth is to continue, we shall be left to decide the future of our Navy with reference only to the possibility of war with foreign powers and to the means of our national defense by proper protection to our coasts and harbors. In this event, our industrial interests must be left to suffer still further injury. Our iron, coal, and timber will decrease in value. The enormous freights we now pay will continue to press upon the producers of our surplus exports. Our merchant-vessels will, in the end, be entirely driven from the sea. And such unjust and ruinous limitation will then be put upon the enterprise of our people that their inventive genius will be restrained and their labor left without just reward. If all this is to be accomplished, the policy which produces it must be based upon the idea that the Navy bears no relation whatever to our commerce, and that the latter can reach every part of the world and encounter all the rivalries and vicissitudes of trade without any protection from it.

If, on the other hand, the government shall adopt such measures as shall put the country in a position to reap the full benefits of its commercial enterprise and secure the profits of our own carrying trade, which properly belong to us, by means of such fostering care as the national government alone has power to give, then our Navy should have such strength and character given to it that it will be able to furnish protection to our commerce wheresoever it may be needed.

Our present Navy is or can be made, without any other than the current annual appropriations, according to the expenditures of the last and the estimates for the present and next fiscal year, amply sufficient to protect our commerce in the present stage of its development. But as our surplus productions are annually increasing, and must be transported to foreign markets or become a total loss in our own hands, the question whether or no the Navy shall be improved so as to provide for this state of anticipated development must either now or at some time in the near future be decided by Congress. Although it cannot be properly considered without reference to the condition of the Treasury and its ability to supply additional appropriations, yet it becomes an important factor in deciding it to remember that if even the $90,000,000 paid for freights during the last fiscal year to vessels sailing under for-

eign flags had been retained at home and allowed to become part of our national wealth, our ability to meet and overcome the embarrassments of trade would have been proportionately increased. This sum, if saved and judiciously expended, would alone be sufficient to make our mercantile marine equal to that of Great Britain and our Navy superior to any in the world. By mistaken and injurious policy, therefore, we have suffered the legitimate fruits of our commerce to be enjoyed by others, and an amount of money to be withdrawn from us and carried abroad in a single year sufficient to accomplish both these results. Whether we consider the present condition of the nations or our own prospective greatness as a people, it is necessary that this policy shall be changed at the earliest possible moment when the financial condition of the country will allow it to be done.

PAY OF THE NAVY.

The difficulties attending a precise adjustment of the pay of the Navy appropriations are of long standing, and some of them seem almost insurmountable. It is believed that more accurate results have been reached during the last year than ever before, but it will require time to give the new system of accounts, authorized by the act of the last session of Congress, a fair trial. In all that is said upon this subject, it should be borne in mind that the methods of accounting heretofore prevailing have had the sanction of long usage, and must, necessarily, have more or less influence upon the results attempted to be reached each year.

The discipline of the Navy necessary to restrain dissipation and desertion among seamen requires that a portion of their monthly pay shall be retained until the end of a cruise or enlistment, often of three years' duration. This standing custom is admitted, on all hands, to be necessary, as the money consideration is the chief hold that the government has upon the average sailor. Thus, money earned in one year and chargeable to that year's appropriation, may not be paid for one, two, or even three years after it becomes due.

Again, the exigencies of the service allow disbursing officers abroad to draw upon the Navy agents in London, because that currency is readily acceptable in all parts of the world. Bills of exchange are drawn at thirty, sixty, and ninety days, or at sight, and as the paper is merchantable after being negotiated by the first holder, it is often held and used by banking-houses or merchants as a means of safe exchange, so that bills drawn at a distant point at ninety days, during the last three months of a fiscal year, may not reach their destination in London until the third and possibly the fourth month of the following fiscal year, and would not be reported at the Treasury until the receipt and settlement of the agent's accounts for the second quarter of that fiscal year. This would bring the charge upon the books of the Treasury against the appropriation for the first year referred to nearly a year after the bill was

drawn. This is an extreme case, but it is given to show how the appropriations for a series of years are interlocked, and also in support of the demonstration that the complications of this fund are not always entirely settled until the year for which the money was appropriated has long passed. A settlement of a year's accounts for pay can never be absolutely determined, because claims for differences and arrears of pay are being continually presented and charges against back years are always arising.

Again, the suspensions made in settlements for lack of form or want of authority often remain a long time, because the disbursing officer does not immediately have the opportunity of correcting the informality; and in case of actual disallowance, the money may be refunded only in installments extending through several years. When the loss is great and suit follows, there may be a loss to a year's stipend through failure of the suit or compromise, which may not be shown for a long time.

Longevity pay, which is an increasing liability yearly, makes a further demand upon this fund. And these little sources of charges upon the appropriations for pay, accumulating all the time, help to make absolute yearly adjustments impracticable. They must always be met and paid from the balance on hand, for the reason that Congress has already fixed the pay by law, which cannot be departed from. And after a number of years have passed it is impracticable, if not impossible, to go back and get at these minor differences for explanation. Small in amount in individual cases, in ten years they assume large proportions and aggregate a large sum of money.

From these general explanations and this statement of existing facts it is easy to turn to a consideration of figures.

Heretofore the appropriations for pay of the Navy have been based upon estimates of the total earnings of the officers and men arising during the year, and the law requires that the earnings of a given particular year shall be paid only from the money appropriated for that year. This requires that money earned during a defined year, but for any reason not paid, shall be kept separate in the accounts of disbursing officers and on the books of the department, and be carried on from quarter to quarter as a distinct liability for that particular year. The amount of money due and to be appropriated must, therefore, be determined by calculation of the earnings on the pay-rolls, and the amount "remaining unpaid" must form a separate thread in the dealings of subsequent "total credits." The difficulty of a precisely accurate statement is at once appreciated, when the preceding complications of settlements are taken into consideration.

In the summary for the year 1877–'78, the last fiscal year, it is found that there was remaining due officers and men on July 1, 1878, the sum of $684,080.94, and this may be taken as the average running liability of the government for payments to be met at future indefinite periods; but

in order to keep the account strictly correct, the exact amount due each officer and man should be accurately stated, and the balance should be held to pay these persons only. As, however, any legitimate claim may be paid for an amount due on account of misconstruction of law or short payment of any kind not estimated for nor forming a part of the balance on hand at that date, each payment of any such claim depletes the remaining part of the appropriation and makes an actual deficiency, because every person owning a share of the balance held could not then receive his part if payment was afterward attempted to be made in full to all concerned. This condition of payments from balances has always been a hidden leech upon the pay of the Navy fund.

A fair settlement is now being made with the fiscal year of 1877–'78. The account shows economy and care, and demonstrates that at the end of the year no deficiency existed. But, at the same time, the actual final liability of that year cannot be arrived at precisely until every class and individual claim has been satisfied and every suspension removed. The legislation for the current year was wise in the purpose to have "Pay of the Navy" stand upon its own bottom, to have each grade of officers provided for minutely and by itself, and to have each class of expenditures distinctly appropriated for, in order to reach a definite settlement and have a full allowance of pay to every officer and man in the service.

But the complications of settlements, under the new law, have been made much greater than they were before, and the prospect of closing the cash accounts of the multitude of appropriations has been removed to a more distant day than by former methods under the old law.

To cite a case in illustration: The appropriation "Pay of lieutenants" cannot be closed until the accounts of all paymasters are received and settled finally, without disallowance or suspension, and all claims of pay during the given year have been presented. Every lieutenant must have received every cent due him for ordinary pay, longevity pay, and, in fact, for all the law allows. If the complement of lieutenants has been full, and more of them have been on sea duty than was anticipated and estimated for, and what is known as "Pay miscellaneous" only covers its direct liabilities, then "Pay of lieutenants" must be deficient, yet it cannot be so declared for a long time. And the complications may be additionally increased by the fact, which might frequently occur, that, in the mean time, every lieutenant may have received all he earned, some other appropriation bearing the burden, which could not be removed until the accounting officers of the Treasury ascertained where it rested and provided the necessary tranfers.

The book-keeping of these accounts is not impossible—it is, in fact, very simple; but all the debits and credits are never at hand at the proper time for the yearly adjustments. Hence a final trial balance-sheet for any given year cannot be obtained for the settlements of that year. And if these difficulties are attendant upon the final settlements of the accounts of lieutenants alone under the new system inaugurated

by the act making appropriations for the present fiscal year, it is easy to see how they will be increased when applied to the other seventy-two heads of appropriations specified in that act.

The only practicable mode of obviating the difficulty is to base the estimates and appropriations upon the amount of money actually required to meet the cash demands of the year involved, as has been done for the present year; that is, to appropriate a sufficient sum to pay currently the annual allowance without reference to the year it is earned. The officers are paid from month to month what the pay-rolls show to be due them. They cannot be paid more, because their pay is established by law. In cases of claims for past differences and arrears of pay, the course of payment is provided for by law. The whole plan secures the incidental advantage of having a current balance in the Treasury for use in "General Account."

By this method an accurate statement can be arrived at every year between the expenditures by the rolls and the cash appropriation accounts. The expenditures by the rolls and by vouchers, being the amounts actually paid in money, and not the total earnings, must correspond with the amounts drawn by requisitions. Suspensions, disallowances, and balances due from year to year will work out their own adjustment. They will not interfere with or complicate the yearly calculations and appropriation settlements. An exhibit of expenditures now required by law will afford the Secretary of the Navy and Congress all the information needed for intelligent action in reference to estimates, appropriations, and legislation. If it should be objected that the exact amount of money to be appropriated for a year cannot be ascertained, the objection would be met and overcome by giving a margin under "pay miscellaneous," similar to the excess for pay this year—say the sum of $300,000—with the requirement that the balance on hand at the close of the fiscal year should revert to the Treasury.

SMALL STORES.

It is deemed appropriate to consider separately the subject of "small stores" for the naval service, although it has been directly connected with and in substance an actual factor of the appropriation pay of the Navy. There are manifest reasons why the account should be changed, and this be made a fund or appropriation by itself. Its association with pay of the Navy seems to have been accidental, and it has served to embarrass that appropriation by contributing to its deficiencies, without being of the slightest advantage to the appropriation or the mode of distributing stores as a matter of business. Under the act of Congress for the government of the Navy, approved March 2, 1799, it is provided that "the men shall, at their request, be furnished with slops that are necessary by order of the captain, and the amount delivered to each man shall be regularly returned by the purser so that the same may be stopped out of his pay." Slops at that date meant clothing, tobacco, and all personal wants now embraced in clothing and small stores.

An act approved August 26, 1842, contains this provision:

That all purchases of clothing, groceries, stores, and supplies of every description for the use of the Navy, as well for vessels in commission as for yards and stations, shall be made with and out of the public moneys appropriated for the support of the Navy, under such directions and regulations as may be made by the executive for that purpose; and it shall not be lawful for pursers or other officers or persons holding commission or employment in the naval service to procure stores or any other articles or supplies for and dispose thereof to the officers, or to the crew during the period of their enlistment, on or for their own account or benefit; nor shall any profit or percentage upon stores or supplies be charged to or received from persons in the naval service other than those which are hereinafter prescribed.

SEC. 2. That it shall be the duty of the executive to provide such rules and regulations for the purchase, preservation, and disposition of all articles, stores, and supplies for persons in the Navy as may be necessary for the safe and economical administration of that branch of the public service.

An act of March 3, 1847, provided—

That from and after the passage of this act all moneys derived from the sale of all stores and other articles belonging to the Navy shall revert to that appropriation from which such stores and other articles were originally purchased, and the Secretary of the Treasury is hereby authorized and directed to refund to the appropriation for "clothing for the Navy" the proceeds of all sales of condemned Navy clothing which have been paid into the Treasury of the United States, &c.

Clothing is here separated from the general account of slops, probably because it was then found that it was not self-supporting, and it has since remained a separate appropriation or fund. From time to time, since March 3, 1843, appropriations have been made to replace losses of all kinds, which must inevitably and continually take place in one way or another. The net expenditure or absolute cost of clothing to restore the depleted stock, from March 3, 1843, to June 30, 1876, is $3,209,029.93.

Small stores, as the name indicates, was the minor part of slops, and attention has never been directed to it, because the losses by issue and survey over condemned goods were light in comparison with the losses on clothing, and the margin of balance in pay of the Navy was heretofore abundant to carry the deficiencies produced by these losses. But this always served to reduce the cash balance on hand. Issues have been kept up as at first prescribed. A part of the appropriation for pay of the Navy has since been used to purchase small stores, upon the theory that the money would be returned to the proper place from each man, being "stopped out of his pay and regularly returned by the purser."

At this date, however, all losses and deficiencies to appropriations are carefully guarded against and watched. Estimates, appropriations, and expenditures are rigidly scrutinized, in order to keep within the limits of law. And with this object in view, as well as to avoid all complications of accounts, especially with that of pay of the Navy, it is recommended that "small stores" be made a fixed and separate fund as well as "clothing." The process of purchase and distribution of small stores allows pay of the Navy to be used to buy and place stores in hand.

Stores go from the inspector to shipboard, and are issued according to the wants of the men, and the value of tobacco, soap, thread, &c., received by the men, is checked against their pay; or, in other words, it is paid out as money.

That is all well enough so far, but small stores are bought and placed on board ship at a certain money valuation, and it is meant that they shall be converted into money, and that the appropriation paying for the stores shall be fully reimbursed. Unfortunately, this is not the case. The sum of $1,000 is expended for small stores, representing $1,000 in money for the pay of the men. Nearly every paymaster meets with more or less of loss on issues, by natural shrinkage in weight, or by the waste of mildew, or other destructive elements. When the $1,000 comes to be paid out in stores it is found that, say, $100 in value is waste and condemned stores. Only $900 are paid to the men in stores, and $100 are lost and thrown overboard. To replenish the stores for further issue $1,000 in money is again taken and paid. The small-stores account does not suffer, because the full value of $1,000 is returned, but the appropriation providing the money is $100 out—that much short.

Again, percentage is allowed disbursing-officers for ordinary losses on issue in dealing out small quantities, but Congress has never undertaken to provide that a sum equal to the loss should be appropriated to the fund or appropriation sustaining the money loss. Packages of stores lost entirely, the value of which is never recovered, are not again represented in the appropriation account. The loss forms a deficiency, which is neither tangible nor defined. A part of the former deficiency in pay of the Navy was undoubtedly caused by such losses, which have never come to light so far as the appropriation is concerned. Therefore, to relieve the standard appropriations of such uncertain charges, and to enable the department and accounting officers to make a definite settlement with "small stores," the money hereafter received for the issue and sale of these stores should be covered into the Treasury, under the proper head of "small stores," and expenditures to replenish the stock should be made from that fund, and no longer from the regular appropriations for pay of the Navy or any other than the specific fund designated for that purpose.

NAVAL ACADEMY.

The attention of Congress is specially invited to the report of the Board of Visitors to the Naval Academy, wherein it is shown that this admirable institution continues to entitle itself to the public favor. The system of education is complete in all its departments, and as the means of fitting the cadets for official position in the Navy, cannot be too highly appreciated. In all the departments of study the proficiency of the cadets is in the highest degree satisfactory. In order, however, to assure more efficiency in that of seamanship, navigation, and gunnery, it is deemed expedient to make the exercises somewhat more practical, by

adding to the military drills on shore evolutions upon the water similar to those practiced upon vessels at sea. It is believed that by this means cadet-midshipmen will be better prepared to profit by their practice-cruise, and that, when they reach the grade of masters at the end of two years after graduation, they will be more competent to discharge their duties on board men-of-war at sea. These duties involve both theoretical and practical knowledge of seamanship, and upon the manner and efficiency of their discharge the safety of both vessels and crews may frequently depend.

Steps have been taken to inaugurate this method of discipline and training, and the Department expects to be able, with the means at its control and without any special appropriation for that purpose, to perfect it within a reasonable time. It will require one or two sailing-vessels and several steam-launches. One of the latter has already been supplied, and when others are put in readiness, these vessels will furnish the means of affording instruction to cadet-engineers in the practical duties of their profession, and the cadets generally will be exercised in steam-tactics, of which they have hitherto been deprived by the absence of these facilities.

It is proper to be said that much of the success of this institution is owing to the indefatigable exertions and eminent ability of the distinguished naval officers who have held the position of Superintendent, and to the high scientific and professional attainments of the academic board. The rare executive ability of the late Superintendent is especially worthy of notice; but inasmuch as the necessities of the service have required that he should be assigned to a broader field of official duty, as the commander-in-chief of the Pacific squadron, the department congratulates itself that it has been enabled to supply his place by an officer equally competent and meritorious; one who, by professional training, long experience, and untiring devotion to duty, has displayed the highest qualifications for the position. From his labors and those of the distinguished gentlemen who compose the present academic board there may be reasonably expected to flow the most decided advantages in the future of this national institution. Devoted as they are to the work intrusted to them, and laboring to omit nothing necessary to the personal comfort and professional culture of the cadets under their charge, the institution cannot fail, under their management, to commend itself still further to Congress and the country as worthy in the highest degree of such protection and care as shall be necessary to give it additional efficiency in supplying the Navy with its future officers

It is desirable in the highest degree that special care should be taken in the professional training and education of naval constructors. Well educated and competent constructors are absolutely necessary for the Navy. They are not only required to devise plans of vessels, but to lay down their lines, calculate their tonnage and displacement, estimate their speed, adjust their capacity for carrying batteries, and, in fact, to

ascertain beforehand, with absolute accuracy, what the vessel when finished will be capable of doing. The details necessary in all this are exceedingly minute, and the scientific attainments required are of the highest character. The performance of these duties cannot safely be intrusted to incompetent men, and therefore all the leading governments have given special attention to the education of the constructors of their ships of war.

If we are to meet these governments upon terms of equality upon the ocean, either in peace or war, we should be prepared to do so with ships equal to theirs both in sailing and fighting qualities. There is but one way of doing this, and that is by providing a corps of competent naval constructors. The law, as it now stands, makes no provision for the education of such a corps, and I feel it to be my duty to renew the recommendation in my last annual report on this subject. The provisions of the statute having reference to engineers, with a few necessary modifications, if applied to constructors, would accomplish the desired object, and they could be educated at the Academy, like cadet-engineers, with special reference to the details of their professional duty. Every argument in favor of building model engines by cadets applies with equal force to the construction of model ships.

NAVY-YARDS.

The limited means placed at the disposal of the department for the preservation and repair of the several navy-yards have been disposed of during the year with commendable discretion on the part of the officers having them in charge. Rigid economy has been practiced, and no other work has been done than what was found necessary to prevent decay and waste. Like appropriations for the next fiscal year will be similarly applied, if it is the pleasure of Congress that the yards shall be no further improved; and the estimates have been made with this view; although the department feels constrained to say that this will leave many of them without improvements considered absolutely necessary and greatly expose the public property to damage.

The nature of the expenditures will appear from the following detailed statement, and a more satisfactory explanation of them will be found in the accompanying report of the Bureau of Yards and Docks.

KITTERY YARD.—Roofs and foundations of the buildings have been repaired, and necessary improvements have been made upon bridges, wharves, and landing-stages. The hospital building, which was previously in very bad condition, has been thoroughly repaired and renovated, which greatly conduce to the health and comfort of the patients. The grading of the grounds has been continued and drains laid to tide-water, so that the hospital is in better condition than it has ever been. Valuable and necessary improvements have been made to the dry-dock, by refitting the pumps and removing decayed timbers and planks. The

work only which was the most urgent has been done, and much that could have been profitably done, if the appropriation had been sufficient, has been omitted. The whole amount expended during the year under this branch of the service was $54,630.83.

While this yard is in good condition and is one of the best in the country on account of its admirable location and the skill of its mechanics, yet there are several frame buildings in a dilapidated condition and subject to be destroyed by fire, for which more substantial ones should be substituted. Besides this, a flow of water has been secured which, with proper appliances, may be conducted throughout the yard, so that any fire that might occur could be readily extinguished. But these improvements cannot be made without increased appropriations.

Charlestown Yard.—The general repairs at this yard have been of a miscellaneous character, such as repairs to buildings, roads, walks, drains, sewers, and water and gas pipes. It is in admirable condition and the management of those having it in charge is satisfactory. It has every facility for the construction and repair of vessels, and its rope-walk is believed to be unsurpassed in the world. The total expenditure amounted to $80,927.17.

New London Yard.—The sum expended at this yard has been small, in consequence of the limited improvements heretofore made, and amounts only to $6,495.02, which has been used for materials, repair of officers' quarters, and labor.

This yard has been left in an unfinished condition, never having been fitted up for the construction or repair of vessels, or for any branch of manufactures necessary to the naval service. Whether this shall or shall not be done in the future depends upon the discretion of Congress. Its position is a highly advantageous one. No expensive grading of the ground will be necessary, and granite for walls can be readily obtained in the immediate neighborhood. The water is of ample depth, and the harbor has a fine entrance from the ocean. It is navigable at all seasons. As the considerations which enter into the question whether or no it shall be further improved and made fit for the construction and repair of vessels must be decided by Congress, the department, until this is done, can only continue to apply the limited appropriations as heretofore, for the protection and preservation of the public property.

Brooklyn Yard.—This yard has been kept in its present good condition by the utmost care in management, the economical improvement of streets, roads, and wharves, and by the necessary repairs of buildings. The work, like that at Charlestown, has been of a general and miscellaneous character, suitable to the condition of the yard. The whole sum expended during the year is $119,501.90. In order, however, to make such other improvements at this yard as are demanded by its position on the harbor of New York, much of the work now in progress will have to be continued.

League Island Yard.—Very important and material work has been

done at this yard, and but for a recent freshet its general condition would have been greatly improved. The work has necessarily been of a varied character, as the yard has never yet been put in as complete a state of repair as some of those that have been longer established. The total expenditure was $219,445.76, upon the following objects: Saw-mill, guard-house, watch-house, causeway and bridge, dredging and filling in, iron-plating shop, steam-engineering storehouse, docking apparatus, and mold-loft, blacksmith shop and foundery, extension of wharf and grading, repairs of buildings, roads, walks, and wharves. All the work has been well done.

On the 23d of last month very considerable damage was done to this yard by a severe and most destructive gale of wind and rain. The dike surrounding the yard, and which was designed to protect it from the tide-water, was broken through at thirty-five places, and to the width of 1,396 feet. All that part not filled in was submerged to the depth of about 7 feet. A number of buildings were injured, and a large ship-house was entirely destroyed. The work of repairing the dike was begun as soon as the water had sufficiently subsided, and has progressed with all possible dispatch. Repairs of a temporary nature will cost about $15,000, but if they are so made as to furnish future and permanent protection to the island it is estimated that they will cost $50,000.

The condition of this yard should command the serious attention of Congress. Its position in relation to the iron and coal fields of Pennsylvania, and its extensive deep-water front on the Delaware River, combine to render it second to no yard in the country. If left in its present unfinished condition, the property already accumulated there will rapidly deteriorate in value, and the advantages contemplated by its location will be in danger of ultimate loss.

Washington City Yard.—The repairs in this yard have not been as extensive as were required, but have been of a valuable character, confined to buildings, streets, ship-house, and wharves. The sum of $74,529.20 has been expended, and all economically applied, under the most careful and circumspect management. When the condition of the Treasury will allow, the grounds this yard should be somewhat extended, when it can be made equal to any other in the country for building and repairing purposes as well as for manufacturing. A rolling-mill has been constructed at a cost of only $9,953.23, which has the capacity to roll all the iron that may be needed for naval purposes.

Gosport Yard.—The amount expended at this yard has been small compared with its value and importance, being only $76,678.01. A much larger sum could have been advantageously used, in consequence of the absolute necessity for timber-sheds. Without these the large amount of timber collected there is exposed to the weather and is rapidly decaying. The annual loss by this means is almost enough to erect sufficient sheds, but the department is unable to do this without more liberal appropriations. Such appropriations would undoubtedly be good economy.

PENSACOLA YARD.—The amount expended during the year for an iron floating-dock for this yard, authorized by Congress, was $161,788, which has been paid out of the specific appropriation for that purpose. This dock has been built at Chester, Pa., and is now ready to be transported to the yard. Inasmuch, however, as there would be great danger of loss, owing to its great bulk and peculiar structure, if the attempt to transport were made without extreme caution both as regards weather and fitness of means for the purpose, it has been delayed, but will be done at as early a period as possible. When it reaches there it will be a very necessary and important improvement in the condition of this yard, as it will furnish the means of docking ships serving in the Gulf of Mexico. It will be the only dock upon the Gulf coast, and the only one south of the Gosport navy-yard.

It is an important question to decide whether the improvements of this yard shall be continued beyond what can now be done with the means at the control of the department. It is an important point on account of its location, and undoubtedly possesses great advantages because of its contiguity to the live-oak, coal, and iron regions of the South, both for building and repairing vessels. In the event of hostile naval operations in the Gulf it would afford a safe place of rendezvous for our ships, where they could be repaired without having to be taken to the more northern yards. These are questions, however, exclusively for the consideration of Congress.

MARE ISLAND YARD.—The whole amount expended at this yard during the year was $102,658.85, of which $3,448 was applied to yard improvements. So far as these were concerned, the work has been done in a very satisfactory manner, and the yard is in as good condition as could be expected under existing circumstances.

This being the only yard upon the Pacific coast, the necessity for putting it in the best possible condition for the construction and repair of ships is considered imperative. It must always be the point to which all our vessels in the Pacific and the Chinese seas will be carried for repairs, and these cannot be satisfactorily made unless the yard is put in condition and kept so. At the last session of Congress an appropriation of $75,000 was made for the continuance of the dry-dock, and this sum has been judiciously applied for that purpose. The work thus far has been done in a most satisfactory manner, and the necessity for an additional appropriation to complete the dock is absolute. If it is delayed there is danger that the sea-wall may be broken by storms, and, in this event, irreparable injury must inevitably be done.

DOUBLE-TURRETED MONITORS.

Congress, by an act approved June 23, 1874, authorized the expenditure of $849,045 for completing the repairs of such double-turreted monitors as the Secretary of the Navy should select, having in view more ample protection to our harbors and leading commercial cities. The object demanded immediate attention.

The duty imposed upon the department was imperative, in so far as the construction of the vessels was concerned, but the plans upon which they were to be rebuilt was left to its discretion. And, consequently, the incipient step was to determine these, with reference to their fitness for naval warfare, and in view of the progress made at that time in naval architecture. Such monitors as we then had were considered equal to any of their class in the world, but as they were all single-turreted and carried but two guns each, it was essential that the additional displacement required by these new structures should be decided in order to secure to them the necessary effectiveness of war-vessels, and, at the same time, the capacity to carry with safety the additional weight occasioned by double turrets of increased thickness of iron and four guns.

The leading nations, especially Great Britain and Italy, have experienced difficulties in constructing their great armored ships, and have expended enormous sums of money in various experiments, many of which have proved unsatisfactory. When the plans of the five new monitors, the Amphitrite, Miantonomoh, Puritan, Monadnock, and Terror, were decided on, none of the experiments made by these nations had promised more favorable results than might reasonably have been expected from ours. And it may well be questioned whether their subsequent experiments have done so, except in so far as their large guns and improved projectiles have shown the capacity to pierce through heavier iron plating than could then have been done. They have established the fact, however, that a steel projectile, weighing 80 pounds, can be driven through iron armor of 10 inches in thickness, with 33 pounds of powder; and armor of 11 inches with an increase of 3 pounds of powder, fired from a gun weighing 35 tons. With the gun increased to 80 tons and the powder to 100 pounds, 20 inches may be penetrated; and it is to provide for this contingency that these governments are now constructing their large armored vessels. They have, consequently, increased the thickness of their armor from 10, 12, and 14 to 24 inches, and the displacement, as in the case of the English ship Inflexible, to 11,407 tons. Some idea of the cost of such vessels of war may be formed when it is stated that one of the 80-ton guns of the Inflexible was estimated to cost $72,000, which would make the cost of the four $288,000. Ten shots from each of these guns will cost about $6,320 for powder and projectiles. But as the department had none of these experiments before it to guide its action, it had the difficult task to perform of deciding upon the plans of these monitors with the lights before it. And it may be confidently asserted that its decision, when reached, had about it as few if not fewer defects than have attended any like decision in Europe.

It should be observed that, in these European experiments, both guns and targets have been stationary, the results being shown only when the projectile strikes the object aimed at. The process of firing by one ship at another when both are in motion is a different thing. In this case the gun will lose none of its power, but the same accuracy of firing

cannot be obtained. And, consequently, it is yet doubtful whether these large expenditures are justifiable, when it is considered that where one projectile will strike the narrow surface exposed upon a monitor, a large number will fail to do so. Yet the department has, at the same time, considered it to be its duty to profit by them as far as possible, in order to make our means of naval defense and attack equal to those of any other nation.

The turrets already constructed for the Miantonomoh are $10\frac{7}{8}$ inches of laminated iron plating. In addition, it is proposed to band them with an iron plating 5 inches in thickness, so that, when completed, their entire thickness will be $15\frac{7}{8}$ inches. This, however, will not possess the resisting power of that number of inches of solid iron—that of laminated compared with solid plating being about sixty-six one-hundredths to one inch. These turrets, therefore, will have the resisting power of $10\frac{1}{2}$ inches of solid iron. It is believed that, for present purposes, this will be ample. The armor of this ship will be 7 inches of solid iron, so that its resisting power will be $3\frac{1}{2}$ inches less than that of the turrets. It is designed to have her ready for a trial trip at sea during the present winter months, so that her qualities may be tested before the turrets are placed on deck. It is believed, also, that the money already appropriated will be sufficient for her completion, which will be done without unnecessary delay. In the mean time the experiments now in progress in Europe will be carefully noted, so that their results may be made available as far as possible in the completion of the Amphitrite, Puritan, Monadnock, and Terror. Of these vessels the Puritan will be far in advance of the others in her means of defense. She will have 11 inches of solid iron armor and 15 inches of solid iron turrets. When finished she will be one of the best monitors afloat, and probably superior to any war-vessel of her draught of water yet built. For the completion of these vessels additional appropriations must be made. When this is done and these five armored ships are finished according to the original intention of Congress, the Navy will possess 15 single-turreted monitors with two guns each, and five double-turreted with four guns each, making in all 50 guns. And with these floating fortifications added to our other effective naval force, we may confidently rely upon our ability to protect our harbors and large commercial cities against the most formidable fleets in the world.

It should be remarked, however, that in order to complete the power of the monitors for the defense of our harbors, it is necessary that rifled cannon should be substituted for the 15-inch smooth-bores they now carry, which are ineffective against armor of more than 6 inches in thickness. Rifled cannon of 10 inches, of about the same weight, would penetrate the side of any vessel likely to be employed on our coast. The attention of Congress is respectfully called to these facts, so that when an appropriation is made for completing these vessels, these considerations shall not be lost sight of.

TORPEDOES.

The torpedo has become absolutely essential to the effectiveness of any modern system of naval warfare. This terrible instrument has been carried to such perfection that a small shell filled with a few handfuls of composition will utterly destroy the largest ship in the world. When Fulton, in 1810, brought to the notice of the President and Congress the fact that he had, several years before, destroyed a brig of 200 tons by the explosion of a torpedo, the scientific world was incredulous; but the experience of the present verifies the value of his invention and the truth of his predictions. And now the great nations vie with each other in their efforts to add to the destructiveness of the torpedo for purposes both of attack and defense. Our discoveries thus far have equaled, if they have not surpassed, those of other countries, and our naval officers engaged at the torpedo station at Newport furnish almost daily evidence of their ingenuity and proficiency. The Ordnance Bureau has availed itself of every means at its command to facilitate the necessary experiments and inventions, and these, made at comparatively small cost, have already been so perfected as to promise increased improvement in the future.

The torpedo can be as easily exploded below the water as upon its surface, by either concussion or electricity; and by whichsoever of these modes it may be done, it is probably as effective for the defense of harbors and ships as it ever will be. What is desired is to make it more effective for attack, so as to destroy an enemy before he can approach too near. To a certain extent our torpedo-boat, the Alarm, can, with an increase of speed, be relied on for this; and she is, within a radius of 15 feet from her hull, a most formidable vessel of war. It would require but few of such ships to destroy an entire fleet of ordinary steam or sailing vessels. But even the Alarm leaves unaccomplished what is so much desired in naval warfare, that is, the means of sending out the torpedo to such a distance upon the water as to cut off an enemy entirely before he approaches too near. Our experiments have led to the belief that this may be done, with reasonable certainty and within a reasonable distance, by boats carrying torpedoes and steered by electricity, either from the shore or the deck of a ship. As these boats would have neither officers nor seamen on board, they might be captured and lost in the event of failure, but if successful the vessel with which they would come in contact, whether large or small, would be inevitably and immediately destroyed. Other experiments are in progress by which it is expected that a rocket-torpedo may be forced upon the water for a considerable distance, to be determined by the strength and quantity of the powder used, and exploded upon coming in contact with an enemy, dropping the torpedo under the water and firing it below the line of the vessel's armor. This, if accomplished, would be equally destructive. Yet another plan has almost if not entirely reached the

point of actual demonstration. This is by means of a steam-launch, possessing extraordinary speed, so arranged that the explosion of the torpedo may be made to take place while the launch is at full speed, so that two men, if they can escape the balls of an enemy, may pass entirely through a fleet and destroy every ship they succeed in reaching.

Captain Ericsson has constructed a partially submerged and armored vessel, intended for greater speed than any iron-clad, and capable of projecting a submarine shell with great velocity and accuracy to a distance of 300 or 400 yards, which is probably as far as any offensive torpedo is likely to be effective at sea. Some preliminary trials have been made by the inventor, and a board has been ordered by the department, at his request, for an official trial when it is ready for service. The same torpedo can be effectively employed from any vessel fitted with a tube above or below the water and the machinery for ejecting the torpedo.

If the practicability of all or any one of these experiments shall be established, our monitors and torpedo-boats would furnish the amplest protection to all our harbors against any possible enemy, no matter what the size or character of the attacking ships. And inasmuch as we have been the pioneers in this mode of naval warfare, and have produced most satisfactory results from our experiments thus far, the department cannot withhold the expression of the hope that Congress will deal liberally with this branch of the service.

TRAINING SYSTEM.

Too much importance cannot be attached to the system of educating boys for the purpose of manning ships of war with trained seamen. It is now in operation in every navy in Europe. In England it has been found inexpedient to rely upon the merchant marine for the supply of sailors on men-of-war, chiefly because they are not trained to handling guns and small-arms, especially those in modern use. Consequently the compulsory power to withdraw seamen from merchant-ships has been taken away, and the system of instructing boys upon training-ships substituted for it. By this means, in the opinion of the British admiralty, there has been supplied to the British navy a considerable number of the best seamen in the world, who are fully competent for all their duties when first entering upon a cruise at sea. The Crimean war found the British navy almost demoralized or at least very much crippled, for the want of men. The government was, therefore, forced to adopt this system, and the result has been that its navy of 30,000 men is now manned exclusively from its training-ships. During the Franco-Prussian war, when the French Government found its ships unavailable for active warfare upon the sea, it manned the batteries of Paris with its trained seamen-gunners, and they were found as effective in this duty as the regulars of the army. It will be seen from these examples that a government, by means of this system, will always have at its command a force equally effective ashore as afloat. Besides, it is a permanent force,

available for any class or kind of ships. These change with the progress of naval art, and frequently in this inventive age, when experiments are developing new results almost every day; but the men who govern their movements and work their guns remain always the same—are efficient in proportion to their military training. Nor ought we to lose sight of the fact that this system creates a sense of patriotism and veneration for the national flag, which can neither be obtained, nor ought to be expected, from heterogeneous crews, picked up in various seaports without regard to their antecedents or nationality.

Actuated by these and kindred considerations, the department, in April, 1875, issued a circular order directing that, under the Revised Statutes, sections 1418, 1419, 1420, boys between fifteen and eighteen years should be enlisted in the Navy, to serve until they were twenty-one years of age, and designated certain ships for training purposes. Boys have been received on board these ships, always deducting the number received from the actual force of men allowed for the Navy, until, at the present time, the Bureau of Equipment and Recruiting reports that 600 of them, after receiving one year's training, have already passed into the general naval service, where, from the uniform testimony of their commanding officers, they are now performing their duties manfully and well.

From our own experience, therefore, as well as the more mature experience of other nations, it is manifest that yet more important advantages may be expected to result from this training system, if persevered in.

I feel it my duty, consequently, to call attention to the recommendations upon this subject contained in my last annual report, and to invite for the system the protection of Congress. In order to perfect and place it upon a permanent basis it will require the enactment of a law authorizing the enlistment of 750 boys annually, at an expense not exceeding $90,000 per annum, for the purpose of manning the Navy with an intelligent, thoroughly trained and educated class of American seamen, who will feel all the responsibilities and obligations of citizenship. It matters not where these boys are born, their training under the national flag will instill into their minds the duty of its protection against all possible foes.

In this connection I have also the honor to recommend that hereafter all warrant officers in the Navy be appointed from the most intelligent and deserving of these boys; and if, in addition to the introduction of these well educated and trained boys into the grade of warrant officers, recognized rank could be given, as in the English navy, that corps would soon recover from the disrepute into which it has somewhat fallen on account of the professional and physical incompetency of some of its members. And this would, besides, present to the boys a legitimate object of ambition, which would be constantly present in their minds to stimulate them.

Should Congress decide to authorize by legislation the perfection of this system, and thus place it upon a permanent basis, the department will exercise all necessary care in the selection of the boys and in distributing the enlistment through all parts of the country. By this means the Navy will not be left to represent, as it now does, in its *personnel*, only the narrow limits of the seaboard and almost every nationality, but will draw that important element of its organization, the "rank and file," from the vigorous and intrepid young men of the whole country. And it will thereby acquire a character of nationality which it will carry with it wheresoever our ships shall sail.

NAVAL OBSERVATORY.

An act, passed at the last session of Congress, authorized the appointment of a commission consisting of a rear-admiral of the Navy, a colonel of Engineers, and a citizen from civil life, to select a site, within the District of Columbia, for the Naval Observatory, with a view to its removal. They were required to make the selection with reference to healthfulness, clearness of atmosphere, convenience of access, and such other advantages as should be found expedient. The commission appointed for this purpose was composed of Rear-Admiral Daniel Ammen, United States Navy, Brevet Maj. Gen. John G. Barnard, United States Army, and Leonard Whitney, esq. The duty assigned them has been discharged and their report is now laid before you.

It is important that the Observatory shall be removed from the unhealthy position it now occupies with as little delay as possible. The situation is directly exposed to miasmatic influences in such a degree as to require the officers to procure other places of residence, especially during the summer months. This subjects to very great inconvenience those of them whose duties and investigations require almost the constant use of the telescope at night, which is absolutely necessary in their astronomical researches. The removal would facilitate their future investigations by relieving themselves and their families from the influences of an unhealthy atmosphere during the summer season, and could be more economically made now than at a future time when the present buildings will have become more deteriorated in value.

The eminent reputation acquired by the Observatory in the scientific world not only entitles it to be looked upon with pride by the American people, but commends it in the highest degree to the consideration of Congress. There is no kindred institution in the world surpassing it, either in the ability of its corps of professors or in the extent and value of their astronomical researches. Whether considered as a national contribution to one of the most important and interesting of the sciences, or as an auxiliary of the Navy and the commercial marine in rendering the navigation of the sea more safe, it deserves, on the part of Congress, the most liberal patronage.

MARINE CORPS.

This important arm of the naval service deserves the special consideration of Congress. Without the support it has always rendered when called on, the Navy would be deprived, in a great degree, of its strength and military efficiency. The law, as it now stands, authorizes the enlistment of a sufficient number of privates, but as this cannot be done without appropriations necessary for the purpose, it is recommended that whatsoever appropriations are made shall have reference to that object. The number is now so limited that it is exceedingly difficult to supply ships at sea, yards, and stations with the necessary number of men; and unless the department has power to do this the public service must suffer.

The attention of Congress is called to the report of the commandant of this corps. Its wants and necessities are therein set forth. Without specifying any of the points embraced in it, the department commends them to the attention of Congress. And inasmuch as the appropriations called for are so small, compared with the services rendered by the corps, it cannot refrain from expressing the hope that they may be well considered and liberally dealt with by Congress.

NAVAL PROPERTY.

During the eighty-two years, from 1794 to 1876, inclusive, there has been expended the aggregate sum of $418,650,433.51, on account of Ordnance, Yards and Docks, Navigation, Construction and Repair, and Steam Engineering—that is, for tangible and perishable property. It has consisted and, so far as it now exists, yet consists of grounds, buildings, ships, guns, engines, boilers, docks, machinery, instruments, tools, &c. Some of it was obtained during the times of war, when prices were high. From 1812 to 1815, inclusive, the aggregate expenditures were about $18,000,000 in excess of the average ordinary expenditures; and from 1861 to 1867, inclusive, this excess rose to about $313,000,000. It would be imposible now to ascertain what proportion of these amounts is chargeable to the increase of prices occasioned by a state of war, but it is a reasonable estimate to assume that it was about an average of 50 per cent. This per cent. deducted from the total excess of $331,000,000, being $165,500,000, leaves $165,500,000 as a fair estimate of the value of the property rendered necessary by war as compared with the average prices prevailing in times of peace. And this would leave $252,150,433.51 as also a fair estimate of the total value of the tangible and perishable property which has been purchased, during the period of eighty-two years, for the Navy Department, including large sums for necessary experiments, &c., which cannot be estimated.

Inventories of the present tangible property of the Navy, including grounds, buildings, ships, guns, engines, boilers, docks, machinery, instruments, tools, &c., have been taken under instructions from the depart-

ment. The approximate total value is $118,295,832.50, as shown by a table which accompanies this report. This, deducted from the foregoing estimate of original cost, shows the decrease in value as compared with the total cost to be $133,854,601. If this loss had been occasioned in the brief period of a year, or a few years, the amount would appear large. But it is to be remembered that it has been continuing through eighty-two years, and has been occasioned by use, decay, and other natural causes of deterioration, as well as, in a large degree, by the fact that when naval or any other public property has been sold at auction it has almost invariably produced less than the original cost. Including all these inevitable sources of diminution in value, however, the loss does not exceed a rate well accounted for by natural and other causes over which the department has had no control.

Although, of course, in such large expenditures there must sometimes have been extravagance and waste, it may be confidently asserted that the general average of loss and deterioration is not greater than ordinarily occurs in the management of other kinds of tangible property, whether used by the public or by private citizens. Some percentage of loss beyond this may have occurred from the want of the necessary appropriations for preservation and repair, with which the department is not justly chargeable. Nor is it chargeable for deterioration in value from natural causes. Ships, houses, &c., built of timber are subject to decay, as are iron and all kinds of machinery to deterioration, under the influence of laws beyond human control. They may, however, be preserved somewhat beyond the natural period of this decay and deterioration by extreme care, which, in the case of public property, can only be provided when the necessary appropriations are made for the purpose.

In regard, therefore, to the naval property now on hand, the department can only respectfully suggest that it is not within its power to prevent its decay and deterioration, and that it cannot provide for its improvement and preservation without the necessary appropriations for that purpose. With the faithful disbursement of whatsoever is given to it with this view it is justly chargeable. Beyond this it is not, and ought not to be.

R. W. THOMPSON,
Secretary of the Navy.

The PRESIDENT.

SUPPLEMENT.

BALANCES OF APPROPRIATIONS.

BALANCE JUNE 30, 1878.

Bureau of Yards and Docks, 1878:	
Maintenance of yards and docks	$22,116 64
Repairs and preservation at navy-yards	7,687 56
Naval Asylum at Philadelphia	10,881 64
Bureau of Equipment and Recruiting, 1878:	
Equipment of vessels	225,331 29
Contingent, equipment and recruiting	13,548 00
Bureau of Navigation, 1878:	
Nautical Almanac	5,533 21
Hydrographic work	18,245 81
Contingent, navigation	971 19
Bureau of Ordnance, 1878:	
Ordnance and ordnance-stores	17,662 66
Torpedo corps	924 22
Bureau of Construction and Repair, 1878:	
Construction and repair	37,863 73
Bureau of Steam Engineering, 1878:	
Steam machinery	28,230 09
Bureau of Provisions and Clothing, 1878:	
Provisions, Navy	100,541 66
Contingent, provisions and clothing	2,195 27
Bureau of Medicine and Surgery, 1878:	
Surgeons' necessaries	545 79
Repairs and improvements	8,304 60
Contingent, medicine and surgery	688 83
	501,272 10

Total approximate value of property belonging to the United States Navy.

Portsmouth, N. H	$6,634,899 91
Boston, Mass	18,507,495 52
New York, N. Y	23,757,134 90
League Island, Pa	3,396,014 36
Washington, D. C	5,394,940 95
Norfolk, Va	7,847,897 94
Pensacola, Fla	2,879,587 80
Mare Island, Cal	7,181,720 78
Newport, R. I	328,183 71
New London, Conn	75,571 00
Key West, Fla	228,986 85
Marine Barracks, Washington	17[illegible],000 00
Marine Barracks, Portsmouth	104,100 00
Naval Hospital and Marine Barracks, Norfolk	1,009,775 00
Naval Asylum, Philadelphia	976,[illegible]00 00
Naval Hospital, New York	77[illegible],186 72
Naval Academy, Annapolis, Md	1,286,490 26
Value of boilers and engines on ships	3,218,685 79
Value of ordnance stores on vessels in commission October 26, 1878	1,372,8[illegible]9 54
Cost of equipment outfits of vessels in commission July 1, 1878	2,2[illegible]9,000 00
Property under cognizance of Bureau of Navigation, Washington	84[illegible] 00
Value of hulls of ships belonging to United States Navy	29,000,[illegible] 00

Value of stores under cognizance of Bureau of Provisions and Clothing on vessels in commission and in storehouses and store-ships on foreign stations	$826, 045 59
Value of stores under cognizance of Bureau of Medicine and Surgery on vessels in commission and in Naval Dispensary at Washington	31, 000 00
Naval Hospital and Bellevue Magazine, Washington	217, 908 88
	118, 295, 832 50

Appropriations and expenditures of the Navy Department for the years 1794 *to* 1876, *inclusive.*

Year of expenditure.	Amount of annual appropriation.	Expenditure by warrants.	Repayments.	Amount carried to the surplus fund.	Net expenditures.
1794	$768, 888 82	$61, 408 97	....	....	$61, 408 97
1795	....	410, 562 03	....	....	410, 562 03
1796	5, 000 00	274, 784 04	....	....	274, 784 04
1797	487, 000 00	383, 912 95	$1, 281 06	....	382, 631 89
1798	2, 024, 712 00	1, 381, 505 83	158 07	....	1, 381, 347 76
1799	3, 813, 789 89	2, 848, 081 84	....	....	2, 848, 081 84
1800	2, 482, 953 49	3, 448, 716 03	....	....	3, 448, 716 03
1801	3, 042, 352 95	2, 526, 670 42	415, 246 42	....	2, 111, 424 00
1802	1, 719 00	970, 561 87	55, 000 00	....	915, 561 87
1803	1, 144, 797 46	1, 215, 230 53	....	$671, 279 71	1, 215, 230 53
1804	1, 667, 498 45	1, 234, 832 75	45, 000 00	....	1, 189, 832 75
1805	1, 550, 000 00	1, 597, 500 00	....	184 94	1, 597, 500 00
1806	1, 692, 141 44	1, 649, 641 44	....	477, 665 70	1, 649, 641 44
1807	2, 429, 564 47	1, 722, 064 47	....	....	1, 722, 064 47
1808	1, 131, 567 80	1, 884, 067 80	....	....	1, 884, 067 80
1809	2, 916, 902 50	2, 428, 633 80	875 00	....	2, 427, 758 80
1810	1, 664, 640 69	1, 654, 301 70	57 50	....	1, 654, 244 20
1811	1, 870, 274 05	1, 970, 263 34	4, 696 95	....	1, 965, 566 39
1812	4, 304, 669 60	3, 960, 990 40	1, 625 25	2, 500 00	3, 959, 365 15
1813	9, 510, 788 55	6, 448, 100 10	1, 500 00	....	6, 446, 600 10
1814	8, 174, 910 87	7, 312, 899 90	1, 609 30	403, 750 00	7, 311, 290 60
1815	5, 258, 686 25	8, 660, 000 25	....	110, 486 75	8, 660, 000 25
1816	4, 234, 793 77	3, 908, 611 77	333 47	174, 992 25	3, 908, 278 30
1817	3, 814, 598 49	3, 314, 598 49	....	90, 500 02	3, 314, 598 49
1818	3, 508, 695 00	2, 953, 695 00	....	....	2, 953, 695 00
1819	3, 427, 306 95	3, 847, 640 42	....	....	3, 847, 640 42
1820	4, 042, 990 00	4, 387, 990 00	....	....	4, 387, 990 00
1821	2, 709, 243 06	3, 319, 243 06	....	....	3, 319, 243 06
1822	3, 141, 881 52	2, 607, 518 84	382, 629 48	267, 169 30	2, 224, 889 36
1823	2, 822, 484 62	2, 748, 523 87	246, 497 54	....	2, 502, 026 33
1824	2, 948, 969 29	3, 334, 890 00	434, 683 63	....	2, 900, 206 37
1825	3, 667, 706 31	3, 338, 819 65	291, 708 18	159, 780 54	3, 047, 111 47
1826	3, 738, 985 23	4, 644, 649 14	427, 046 12	58, 921 20	4, 217, 603 02
1827	3, 709, 490 35	4, 519, 811 45	260, 012 43	11, 220 97	4, 259, 799 02
1828	3, 898, 205 04	4, 328, 351 66	370, 462 95	64, 876 34	3, 957, 888 71
1829	3, 845, 008 13	4, 041, 879 78	600, 516 55	26, 638 78	3, 441, 363 23
1830	4, 316, 000 47	3, 820, 287 48	574, 613 63	57, 965 36	3, 245, 673 85
1831	3, 496, 643 29	4, 306, 864 80	311, 947 90	26, 269 70	3, 994, 916 90
1832	4, 456, 573 53	4, 088, 626 28	298, 114 31	16, 917 04	3, 790, 511 97
1833	3, 867, 872 01	4, 111, 386 33	211, 846 58	19, 477 54	3, 899, 539 75
1834	4, 548, 252 95	4, 148, 076 22	214, 881 41	70, 874 06	3, 933, 194 81
1835	4, 966, 734 13	4, 044, 616 19	205, 973 82	12, 394 79	3, 838, 642 37
1836	6, 787, 667 96	6, 106, 267 64	302, 703 14	57, 266 86	5, 803, 564 50
1837	7, 465, 057 60	7, 236, 950 18	396, 873 50	98, 814 03	6, 840, 076 68
1838	5, 076, 336 26	6, 522, 559 04	581, 343 60	1, 669, 863 42	5, 941, 215 44
1839	5, 888, 930 96	6, 669, 660 39	477, 784 39	213, 330 34	6, 191, 876 00
1840	5, 789, 679 40	6, 381, 120 21	291, 571 66	4, 152 21	6, 089, 548 55
1841	7, 418, 086 64	6, 496, 001 65	618, 872 41	6, 681 80	5, 877, 329 24
1842	6, 632, 386 82	8, 654, 498 44	381, 521 25	48 92	8, 272, 977 19
1843	3, 641, 300 97	4, 283, 841 27	584, 657 17	....	3, 699, 184 10
1844	6, 048, 456 51	7, 247, 593 53	766, 073 09	2, 550 53	6, 481, 520 44
1845	5, 858, 060 27	6, 914, 667 38	751, 601 75	450 00	6, 153, 065 63
1846	8, 963, 928 10	7, 766, 971 53	1, 434, 237 89	9, 282 98	6, 332, 733 64
1847	7, 591, 784 61	19, 709, 650 56	1, 926, 477 88	2, 846 94	7, 783, 172 68
1848	10, 380, 808 30	11, 654, 212 16	2, 337, 183 21	....	9, 317, 028 95
1849	8, 957, 107 98	10, 241, 094 63	1, 224, 965 80	1, 326, 043 18	9, 016, 128 83
1850	8, 826, 172 54	9, 512, 593 86	1, 796, 736 10	184, 070 85	7, 715, 857 76
1851	8, 697, 046 67	8, 851, 375 93	1, 273, 434 87	2, 575 19	7, 577, 941 06
1852	6, 978, 442 18	8, 786, 832 78	812, 052 70	26, 885 85	7, 974, 780 08
1853	8, 371, 406 71	10, 612, 218 67	1, 112, 289 29	55, 050 77	9, 499, 929 38
1854	12, 198, 103 37	10, 205, 892 91	950, 565 73	80 24	9, 255, 327 18
1855	10, 447, 751 77	13, 362, 986 19	1, 205, 206 50	1, 170 29	12, 157, 779 69
1856	14, 293, 118 49	14, 453, 722 95	1, 778, 521 36	46, 951 39	12, 675, 201 59
1857	12, 716, 584 55	13, 323, 202 16	1, 731, 374 22	1, 080 25	11, 591, 827 94
1858	12, 173, 509 36	14, 870, 953 56	1, 703, 011 12	1, 541 32	13, 167, 942 44
1859	14, 906, 329 49	16, 396, 160 31	2, 163, 218 32	60, 040 49	14, 232, 941 99
1860	10, 279, 483 03	13, 019, 908 71	1, 701, 412 97	....	11, 318, 495 74
1861	23, 305, 139 51	14, 383, 677 45	1, 996, 520 93	69, 426 27	12, 387, 156 52

Appropriations and expenditures of the Navy Department, &c.—Continued.

Year of expenditure.	Amount of annual appropriation.	Expenditures by warrants.	Repayments.	Amount carried to the surplus fund.	Net expenditures.
1862	$55,700,422 71	$45,074,548 30	$2,434,195 21	$15,362 66	$42,640,353 09
1863	143,916,769 35	66,441,513 11	3,180,398 10	32,891 33	63,261,235 31
1864	118,910,288 32	92,283,632 03	6,578,678 29	....	85,704,963 74
1865	124,882,467 07	130,404,702 76	7,787,268 69	900,459 39	122,617,434 07
1866	2,156,197 87	62,428,915 70	19,143,253 70	407 90	43,285,662 00
1867	20,033,616 56	43,352,167 46	12,277,201 56	39,993 03	31,074,965 90
1868	16,642,868 11	34,942,769 87	8,672,343 48	65,026,583 54	26,270,426 39
1869	17,687,297 48	28,998,993 98	9,136,380 69	....	19,862,613 29
1870	17,905,952 77	27,499,324 76	5,292,733 12	3,331,446 40	22,206,591 64
1871	20,617,650 38	22,650,302 54	2,782,773 18	....	19,867,529 36
1872	21,192,081 46	24,494,301 20	2,764,376 67	185,864 39	21,729,924 53
1873	23,635,779 69	27,054,364 22	3,323,548 33	39,974 00	23,730,815 89
1874	26,197,216 06	37,783,793 67	6,924,446 21	....	30,859,347 46
1875	19,162,134 69	25,443,774 85	4,043,719 42	232,979 75	21,400,055 43
1876	18,872,725 06	23,496,843 51	4,576,872 82	3,090 82	18,919,970 69
Total	1,018,251,452 08	1,075,865,613 24	134,576,627 87	76,373,122 32	941,288,985 37

DETAILED REPORT OF THE MOVEMENTS OF VESSELS.

NORTH ATLANTIC STATION.

The force on this station is under the command of Rear-Admiral John C. Howell, who relieved Rear-Admiral S. D. Trenchard September 1, and hoisted his flag on the Powhatan the 14th of that month. It comprises the Powhatan (flag-ship), 17 guns; Plymouth, 12 guns.

The iron-clads Ajax, Catskill, Lehigh, Mahopac, and Manhattan (in partial commission at Brandon, James River, Virginia); the Montauk, Passaic, and Wyandotte (in partial commission at Washington, D. C.), are available for duty on this station. The iron-clad Canonicus remains in commission at New Orleans, La. The New Hampshire and Pawnee continue store-ships at Port Royal, S. C.

The Swatara, Ossipee, and Enterprise were attached to the station at different times during the year.

The Powhatan left Norfolk, Va., January 20, for a cruise to the West Indies, and visited St. Thomas; Santa Cruz; St. Kitts; St. Pierre, Martinique; Bridgetown, Barbadoes; Kingston, Jamaica; Santiago de Cuba; and Havana, arriving at the last-named port March 14. On the 17th left, and arrived at Norfolk, Va., the 28th, having touched at Port Royal, S. C. Sailed for New York May 21, and reached there the next day. Having received new boilers there, left September 25, and arrived at Portsmouth, N. H., the 27th. Departed thence October 14; reached Boston the next day; left the 21st, and arrived at New York the 23d.

The Plymouth returned to Norfolk, Va., January 26, from a cruise to Puerta Plata and Aspinwall. April 18, left and proceeded on a cruise to the West Indies, visiting Puerta Plata; Samana Bay; Kingston, Jamaica; Vera Cruz; and Brazos Santiago, Tex., reaching the last-named place May 23. Left the 25th, and after a short stay at Pensacola, Fla., arrived at New York the 22d of June. On the 25th of September sailed for Portland, Me.; reached there the 28th, and departed thence October 3 (touching at Portsmouth, N. H.) for St. Croix, West Indies, to look after American interests, an insurrection having broken out at that place. Arrived there the 19th of October, and is under orders to the Virgin Islands, St. John's, Porto Rico, St. Domingo City, and Port au Prince, and to return to Hampton Roads, Virginia.

The Swatara arrived in Samana Bay January 24, twelve days from

Norfolk, and remained until February 15, when she sailed, and visited Puerta Plata, Cape Haytien, Port au Prince, Santa Marta, Savanilla Bay, Cartagena, and Aspinwall, at which last-named port she arrived March 29, and remained till April 13, when she left for Vera Cruz, Mexico, arriving there May 11. After being engaged a short time surveying there, proceeded to New Orleans, La., arriving the 24th. June 10 sailed, touching at Pensacola and Key West, Fla., and reached Boston the 29th. On the 5th of November she was put out of commission.

The Ossipee left Norfolk January 22, arrived at Kingston, Jamaica, February 6, Brazos Santiago, Tex., March 27, and Pensacola the 31st. Left April 16, visited Havana, and arrived at Hampton Roads the 27th. Sailed May 1, reached Boston the 10th, and was put out of commission the 25th.

The Enterprise left New Orleans, La. (having been engaged on surveying duty in the harbor since November, 1877), March 23, and arrived at the Norfolk navy-yard April 9. On the 13th of that month was detached from the North Atlantic Station. (See movements of vessels on special service.)

SOUTH ATLANTIC STATION.

Rear-Admiral Edward T. Nichols is in command of the force on this station, which consists of the Hartford (flag-ship), 18 guns, and the Essex, 6 guns.

The Hartford arrived at Rio de Janeiro, Brazil, from Norfolk, Va., in December, 1877, and on the 19th of that month sailed for Montevideo, Uruguay, which port she reached January 2. June 3, in company with the Essex, left and arrived at Rio de Janeiro the 20th, having stopped at Maldonado.

The Essex arrived at the island of St. Helena January 2 (after the expiration of her cruise to Liberia and the west coast of Africa), and at Rio de Janeiro February 10; departed thence and arrived at Montevideo March 19. On the 16th of May proceeded to Colonia, on the Rio de la Plata, and Ensenada de Barragan; returning to Montevideo, where she remained till June 3, and then sailed for Rio de Janeiro, arriving there the 20th. Sailed September 21 for the island of Tristan d'Acunha to relieve the crew of the wrecked ship Mabel Clark.

PACIFIC STATION.

The North and South Pacific Stations have been consolidated, and the force on the Pacific Station, under the command of Rear-Admiral C. R. P. Rodgers, who relieved Rear-Admiral Alexander Murray, now comprises the Pensacola (flag-ship), 22 guns; the Alaska, 12 guns; the Lackawanna, 10 guns; and the Adams, 6 guns. The Onward remains as store-ship at Callao, Peru.

Rear-Admiral George H. Preble, who commanded the South Pacific, left that station in the Omaha, his flag-ship, December 4, 1877.

The Pensacola remained at Honolulu until early in April, when she left for San Francisco, Cal., and arrived at the Mare Island navy-yard, for repairs, May 1. Rear-Admiral Rodgers assumed command of the station July 11, relieving Rear-Admiral Alexander Murray, detached on his own application. On the 13th of November the Pensacola left the Mare Island navy-yard on a cruise along the coast of Mexico and as far south as Valparaiso.

The Lackawanna, upon her return from Puget Sound, was put out of commission at the navy-yard, Mare Island, January 24. After having

been repaired and refitted, she was, September 24, again put in commission, and left San Francisco October 30 on a cruise along the coast of Mexico and Central America.

The Alaska was put in commission at the navy-yard, New York, April 23; sailed June 14, reached Pernambuco, Brazil, July 19, and Rio de Janeiro July 30; arrived at Valparaiso, Chili, October 1, and Callao, Peru, the 23d.

The Adams sailed from Montevideo, Uruguay, November 1, 1877; on the 12th, while at anchor off Sarmiento Bank, received notice of a serious mutiny at Sandy Point, Straits of Magellan; proceeded there and offered assistance to the governor, and at his request remained until security was restored. For the services rendered, the commanding officer of the Adams received the thanks of the authorities of Chili. Arrived at Valparaiso December 14; left January 1, reached Callao the 11th, and Panama the 21st. Sailed May 10, with the Samoan ambassador and suite as passengers, and arrived at Apia, Samoan Islands, June 28.

The Omaha left Callao December 4, 1877, and arrived at Hampton Roads, Virginia, April 19, 1878, where Rear Admiral Preble hauled down his flag, and the vessel was ordered to Portsmouth, N. H., and was put out of commission there May 9.

EUROPEAN STATION.

The following vessels comprised, till November, the force on this station, which continues under the command of Rear-Admiral William E. Le Roy: Trenton (flag-ship), 11 guns; Vandalia, 8 guns; Marion, 8 guns; Alliance, 6 guns.

The terms of the Vandalia and Marion having expired, they have been ordered to return to the United States, and are now on their way.

The Quinnebaug, 8 guns; Wyoming, 6 guns; and Enterprise, 6 guns, have been designated for duty on this station.

The Trenton left Villefranche Harbor, France, December 25, 1877, and arrived at Smyrna, Turkey, January 2 following, where she remained until the 16th of March; departing that day she sailed for the Piræus (the harbor for Athens), Greece, and remained at that place till April 2; left that day, reached Villefranche the 7th, departed thence on the 27th, and arrived at Spezia, Italy, the next day, where she remained until June 11, when she sailed and reached Leghorn, Italy, the same day; remained at Leghorn till July 17, when she sailed for Gibraltar, arriving there the 24th, and at Lisbon, Portugal, the 26th; sailed thence the 30th, and arrived at Cherbourg, France, August 4; left September 3, and arrived off Netley, near Southampton, England, the same day; on the 25th sailed and anchored off Yarmouth, Isle of Wight; got under way the 26th, and arrived at Villefranche the 16th October.

The Vandalia left Villefranche December 13, 1877 (having Ex-President Grant on board), and visited Genoa, Naples, Palermo, and Malta, leaving the last-named port on the 31st for Alexandria, Egypt. Visited Alexandria, Port Said, Jaffa, and reached Smyrna February 22; departed thence the 27th, and arrived at Constantinople March 1; left there the 6th, and reached the Piræus the 8th. On the 15th, left for Naples, arriving the 18th; after a few days' stay, sailed for Villefranche (General Grant having left the ship). Left Villefranche April 23 for Smyrna, where she arrived May 2, having touched at Malta April 27. Remained at Smyrna till July 9, and, visiting Latakinjah, reached Beirût the 16th. Left there the 27th, visited Messina, Naples, and Villefranche, arriving at the last-named port August 15, and remaining till

the 21st of September, when she sailed and reached Barcelona, Spain, the 23d; left the 30th and arrived at Cartagena October 1. On arrival at Port Mahon, Spain, received orders to Villefranche, which port she reached the 24th, and sailed homeward bound the 27th.

The Marion left Villefranche in January, and arrived at the Piræus February 1, and remained there till the 14th of March. Sailed that day for Smyrna and reached there the 15th. On the 10th of April left Smyrna for Volo, Turkey in Europe, to afford protection to an American citizen, and received assurance that he and all Christians in Volo should have ample protection; departed thence the 12th and returned to Smyrna the 13th. May 3, left for Villefranche, and sailed from there the 15th for Gibraltar, where she arrived the 20th, her commanding officer having been appointed arbitrator on a question of boundary between Great Britain and Liberia. The arbitration having been postponed, the Marion left June 27, and reached Villefranche July 1. On the 15th sailed for Barcelona, Spain, where she arrived the 17th; left August 24 and reached Leghorn, Italy, the 31st; sailed thence September 10, and arrived at Naples the 12th; departed the 1st of October and reached Trieste, Austria, leaving there the 22d for Villefranche, where she arrived November 2, and sailed homeward bound the 14th.

The Alliance left Villefranche in February and arrived at Smyrna the 24th, and departed March 5 for the Piræus, reaching there the 8th and remaining till the 28th, when she sailed, and, touching at Messina and Naples, arrived at Villefranche April 10; left May 18 and reached Marseilles the 19th. On the 28th of May sailed, and arrived at Barcelona June 1, left the 5th, reached Port Mahon the 6th, and sailed on the 8th; visited Malaga, and arrived at Gibraltar the 17th; left the 22d for Cadiz, Spain, visited Tangiers, and arrived at Cadiz the 24th. On the 1st of July sailed and visited Lisbon, Portugal, and Havre, France, arriving at Havre the 11th. Left August 6, visited Cherbourg and Gibraltar, and arrived at Villefranche the 19th. On the 18th sailed and reached Leghorn the 20th; sailed thence the 27th for a cruise in the eastern waters, making Smyrna her headquarters.

The Quinnebaug was put in commission at League Island, Pennsylvania, October 2, 1878; left the 17th for Norfolk, where she arrived on the 20th.

The Wyoming left Washington on the 2d of November and New York the 26th for duty on this station.

The Enterprise left New York on the 16th November for duty on this station.

ASIATIC STATION.

Rear-Admiral Thomas H. Patterson continues in command of this station, and the force comprises the Monongahela, 11 guns; Monocacy (temporary flag-ship), 6 guns; Ashuelot, 6 guns; Alert, 4 guns; Ranger, 4 guns, and Palos.

The Tennessee, the former flag-ship on this station, returned to the United States in July, 1878; and the Kearsarge also returned. These vessels have been put out of commission.

The Richmond is under orders to leave Boston, to report for duty as the flag-ship.

The Tennessee left Yokohama, Japan, December 4, 1877, arrived at Kobe the 6th, Nagasaki the 11th, and Shanghai, China, the 20th. On the 7th January left, and reached Hong-Kong, China, on the 21st, having stopped at Amoy. On the 2d of March sailed for New York, via the Suez Canal, and arrived July 6. She was put out of commission on the 23d.

The Monongahela left New York September 22, 1877, and reached Hong-Kong March 12, 1878. On the 29th sailed for Shanghai for repairs, arriving the 9th of April, and was there at last accounts.

The Monocacy arrived at Nagasaki from Kobe December 1, 1877, at Shanghai the 7th, Amoy the 13th, Hong-Kong the 19th, and at Bangkok January 7, 1878. On the 28th left and reached Saigon, Cochin China, February 1, and Hong-Kong the 15th. On the 2d of March Rear-Admiral Patterson transferred his flag from the Tennessee to the Monocacy, and left with that vessel on the 7th, visiting Swatow, Amoy, Foochow, and Ningpo, and arriving at Shanghai the 26th. Left May 1; reached Nagasaki the 6th; remained there till the 20th, when proceeded to Yokohama, touching at Kobe, and arriving at Yokohama the 29th, where she was at last accounts.

The Ashuelot arrived at Shanghai for repairs November 27, 1877, from Tientsin, and remained till April, 1878, when sailed and arrived at Nagasaki. Surveyed the Meac Suna group and Pallas Rocks to determine their position; visited Kobe, and arrived at Yokohama August 23. Left October 3; arrived at Kobe the 5th, under orders to Bangkok, Siam, visiting *en route* Nagasaki, Foochow, Amoy, Hong-Kong, and Manila, and on her return to call at Saigon, Pak-hoi, and Hoi-How.

The Alert left Yokohama March 8, 1878, and arrived at Shanghai the 16th. Left in the latter part of April for Amoy and Swatow, and inquired into the alleged coolie traffic, and was at last accounts at Foochow, under orders to Swatow, Amoy, and Hong-Kong, to search on the way for the rock upon which the American bark Forest Belle is alleged to have struck.

The Ranger left Shanghai January 5, 1878; Amoy February 4; arrived at Hong-Kong, having touched at Swatow, the 13th; visited Canton; and on the 27th sailed for the island of Formosa to afford relief at the wreck of the American bark Forest Belle. Arrived at Amoy March 8, and in the latter part of April left for Hong-Kong, Whampoa, Macao, and Canton, and inquired into the alleged coolie traffic. Was at last accounts at Hong-Kong, under orders to Nagasaki, Kobe, and Yokohama.

The Palos left Shanghai April 30, 1878, and visited Cheefoo, New Chwang, and Tientsin and was at last accounts at Tientsin, with orders if her services are not required there, to leave for Shanghai.

The Kearsarge left Nagasaki September 3, 1877, and arrived at Boston (via the Suez Canal) December 30. She was put out of commission at Portsmouth, N. H., January 15, 1878.

SPECIAL SERVICE.

Surveying duty.

The Enterprise sailed from Norfolk, Va., for Para, Brazil, May 1, and arrived there the 24th. Having completed the survey of the Amazon and Madeira Rivers, which she was ordered to make, left Para September 7, and reached New York on the 25th.

The Tuscarora was put in commission at the navy-yard, Mare Island, Cal., January 10, 1878, and left on the 28th to make soundings by running an open traverse from San Diego to Cape Saint Lucas, defining the true ocean-bed; to locate the "Tartar Shoal"; and make a good running survey of the coast of Guatemala, &c. She returned to San Francisco October 15, and left, to resume her work, on the 28th of November.

The Gettysburg has continued her survey of ports in the Mediterra-

nean, and the Guard her astronomical work on the coast of Portugal and of Brazil. The last-named ship has returned to the United States, and was put out of commission at Portsmouth, N. H., December 14.

The Ticonderoga was put in commission at the navy-yard, Portsmouth, N. H., November 4, reached Norfolk, Va., the 27th, and sailed on her cruise December 7.

Commodore R. W. Shufeldt has received instructions to proceed with that vessel on a special cruise in the interests of commerce and navigation along the east and west coasts of Africa and to the East Indies. Commodore Shufeldt has also been designated as arbitrator in a pending question between Great Britain and Liberia, with regard to the northwest boundary between the latter country and the British possessions on the African coast.

PARIS EXPOSITION.

Under the 3d section of the act of Congress approved December 15, 1877, the following-named vessels were assigned the duty of transporting articles for the Universal Exposition at Paris, viz: Constitution, Constellation, Wyoming, Portsmouth, and Supply.

The Constitution was put in commission at Philadelphia January 9, 1878, left on the 28th of February, and arrived at Havre, France, April 2.

The Constellation left New York March 27, and arrived at Havre April 22. After discharging her cargo, left May 11 and returned to New York, arriving there July 7.

The Wyoming left New York April 6, and arrived at Havre the 22d. After discharging cargo, visited Rouen, France, and Southampton, England, which last-named port she left June 25, and reached Norfolk, Va., August 22, and Washington September 15.

The Portsmouth having arrived at Washington February 16, after a sail of nearly four months from San Francisco, Cal., left the 27th for New York, reached there March 6, and sailed the 16th for Havre, arriving at the last-named port April 6. On the 1st of November left Havre for New York.

The Supply was put in commission at New York January 14, and sailed February 25 for Havre, arriving there March 22.

TRAINING-SHIPS, ETC.

The Minnesota and Saratoga have been used as training-ships for apprentices in the Navy; the former has cruised in Long Island Sound, and the latter along the Atlantic coast and to the Bermuda Islands.

The Constellation and Mayflower have made their usual practice-cruises with cadet-midshipmen and cadet-engineers respectively.

The Jamestown (California) and the St. Mary's (New York) continue to be used under the act of Congress of June 20, 1874, as State marine school-ships.

The Rio Bravo has remained on the Rio Grande. The Michigan has made her usual cruise in the lakes; and the Tallapoosa has made her regular trips as a dispatch-vessel from Washington to the navy-yards and stations.

The Speedwell has been on duty connected with the United States Fish Commission during the summer, and until October 12, when she was put out of commission at the navy-yard, Washington.

The Despatch has continued on special duty at Constantinople.

APPENDIX.

No. 1.—ESTIMATES, SECRETARY'S OFFICE.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.		
Secretary, per act June 19, 1878	$8,000	
Chief clerk, per act June 19, 1878	2,500	
Disbursing clerk, per act June 19, 1878	2,000	
For four clerks class four, per act June 19, 1878	7,200	
For two clerks class three, per act June 19, 1878	3,200	
For one stenographer, per act June 19, 1878	1,600	
For one clerk class two, per act June 19, 1878	1,400	
For four clerks class one, per act June 19, 1878	4,800	
For three clerks, at $1,000 each, per act June 19, 1878	3,000	
For two messengers, per act June 19, 1878	1,680	
For two laborers, per act June 19, 1878	1,320	
	36,700	$36,700
CONTINGENT EXPENSES.		
For stationery, furniture, newspapers, and miscellaneous items, per act June 19, 1878	2,500	2,500
SALARIES, BUILDING.		
Superintendent, per act June 19, 1878 (R. S., p. 69, sec. 416)	250	
For five watchmen, per act June 19, 1878	3,300	
For two laborers, per act June 19, 1878	1,320	
	4,870	4,870
CONTINGENT EXPENSES.		
For incidental labor, fuel, lights, and miscellaneous items, per act June 19, 1878	5,000	5,000
POSTAGE.		
For official postage-stamps for the Secretary's Office and the bureaus of the Navy Department, per act June 19, 1878	20,000	20,000
PAY OF NAVY.		
For officers on sea-duty, officers on shore and other duty, officers on waiting-orders, officers on retired-list; clerks; extra pay to enlisted men, exchange and mileage, officers in excess of present list, and changes of duty, &c., pay of petty officers, seamen, ordinary seamen, landsmen, and boys, including men in the engineers force, and for the Coast Survey service, 7,500 men, at the pay prescribed by law; appropriated May 4, 1878	7,350,000	7,350,000
CONTINGENT, NAVY.		
Rent and furniture of buildings and offices not in navy-yards; expenses of courts-martial and courts of inquiry, boards of investigation, examining boards, with clerks' and witnesses' fees, and traveling expenses and costs; stationery and recording; expenses of purchasing-paymasters' offices at the various cities, including clerks, furniture, fuel, stationery, and incidental expenses; newspapers and advertising; foreign postage; telegraphing, foreign and domestic; copying; mail and express wagons, and livery and express fees, and freight; all books for the use of the Navy; care of library; experts' fees and costs of suits; commissions, warrants, diplomas, and discharges; relief of vessels in distress, and pilotage; recovery of valuables from shipwrecks; quarantine expenses; care and transportation of the dead; reports, professional investigation, and information from abroad; and all other emergencies and extraordinary expenses, arising at home or abroad, but impossible to be anticipated or classified; appropriated May 4, 1878	83,000	83,000
PRINTING AND BINDING.		
Printing and binding for the Navy Department, to be executed under the direction of the Public Printer, per act June 20, 1878 (R. S., p. 720, sec. 3661)	53,000	53,000

No. 2.—NAVAL ACADEMY.

REPORT OF SUPERINTENDENT.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., November 18, 1878.

SIR: I have the honor to report to the department that, in obedience to its orders, I relieved Rear-Admiral C. R. P. Rodgers as superintendent of this Academy on the 1st of July last.

The academic year had then just closed, and the cadet-engineers had sailed in the Mayflower on their summer cruise. Owing, however, to the non-arrival of the Constellation from Europe, the cadet-midshipmen detailed for sea-service did not leave Annapolis till the 24th of July.

During the month of August I visited the Constellation and the Mayflower, and found them in a highly efficient condition. In September I returned to the Academy. On the 14th of September, 134 candidates for appointment as cadet-engineers presented themselves, of whom the 25 best qualified were received into the Academy, arranged in the order of merit, according to law.

The examination of candidates for admission as cadet-midshipmen commenced September 23, and 17 were found duly qualified, and admitted into the Academy. These, with the 24 admitted in June last, make a total of 41 cadet-midshipmen appointed this year. There now remain in all, attached to the Academy, 268 cadet-midshipmen and 102 cadet-engineers.

The estimates for the support of this institution for the fiscal year ending June 30, 1880, were transmitted to the department on the 15th ultimo, and I have submitted for insertion in the "sundry civil bill" an estimate of $60,000 for the erection of an additional wing to the quarters of the cadets. This estimate has also been submitted by my predecessor, and the improvement recommended is considered a highly necessary one.

In conclusion, I take pleasure in referring to the reports of Commander H. L. Howison and Lieut. Commander A. D. Brown, the commanding officers of the practice-ships, as showing the able and efficient manner in which they, and all the officers under their command, performed their arduous and important duties, and as giving evidence of the general good conduct and fine bearing of the cadets.

I am, sir, your obedient servant,

FOXHALL A. PARKER,
Superintendent.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

REPORT OF BOARD OF VISITORS.

UNITED STATES NAVAL ACADEMY,
June 20, 1878.

SIR: The board of visitors appointed to attend the annual examination at the United States Naval Academy have the honor to submit the following report of their proceedings:

The board met on the 11th instant—all the members, except General Wager Swayne and Dr. A. Wheeler, being present—and organized as

follows: Rear-Admiral John L. Worden, president; Maj. Gen. Jefferson C. Davis, vice-president; and Master S. A. Staunton, secretary.

The usual committees were appointed, and at least one session held daily.

The board desire to express their satisfaction at the readiness with which the superintendent and those under his command have supplied to the various committees the information wanted, and the cheerfulness with which their labors were facilitated.

The Rev. Dr. A. Wheeler, a member of the board, arrived on the 12th instant.

SEAMANSHIP, NAVIGATION, AND GUNNERY.

It is found that in the departments of seamanship, gunnery, and navigation the cadet-midshipmen show a high degree of proficiency, bearing evidence of the careful training they have undergone from their instructors, both theoretically and practically, in these important branches, so eminently professional in their character, without a knowledge of which no midshipman can expect to be a thorough sea-officer.

The board also are of the opinion that, while not desiring in the least to disparage the exercises of the midshipmen on board the Dale, and which were of the most creditable character, yet we are somewhat inclined to believe that these exercises could be more efficiently conducted in a vessel *under way*, thereby imparting a more thorough practical knowledge of evolutions similar to those on board of a ship of war in commission, and therefore reiterate the recommendation of the previous board that two sailing-brigs be substituted for the Dale, which is now "tied up" at the wharf. In addition to these vessels, we would respectfully suggest that one of the class of the Wachusett be obtained and fitted with a light spar-deck which would give ample room for working ship and battery below. A vessel of the class referred to would also afford instruction to the cadet-engineers in the practical duties of their profession, and which can be acquired more thoroughly in a vessel under way. A better class of boats should be supplied for the boat-guns, and also new and lighter built boats for the exercises in which the present ship's boats are now used. Six small steam-launches precisely similar for fleet tactics would be extremely useful in this important branch of an officer's education.

STEAM.

The instructions in the very important department of steam-engineering are thorough, and given in most of its branches, theoretical and practical. We consider it desirable, as regards the latter, that another shop be added, so that in this respect the course may be more complete.

The practical work should be extended in connection with the art of designing machinery, in order that the cadet-engineer may be educated in not only a knowledge of the forms and proportions required by theory, but in a knowledge of the best way of practically executing the work with reference to the tools employed. It is desirable to give him a knowledge of the cost of material and time of different modes of effecting substantially the same objects. This is not done in the efficient manner it should be, for want of space and tools, both being inadequate for the number of cadets.

The teaching of the use and manipulation of the various organs of steam machinery is done by means of fine apparatus in the most complete manner.

The designing of machinery, involving an extensive knowledge of descriptive geometry, is also very efficiently taught.

MATHEMATICS AND MECHANICS.

The instruction in mathematics and mechanics is exceptionally good. Throughout the course the aim seems to be, not so much to make the process of mathematics the *end* of study, as to make them the efficient *means* by which practical problems are solved. The increasing importance of mathematics to the modern arts of war on land and sea fully justifies the course here pursued. We desire to mention with special emphasis the work done in some of the *elective branches.*

PHYSICS.

The department of physics shows great recent development. The addititions to the lecture-rooms and laboratories have been made with judgment and exquisite taste. The apparatus includes many pieces of the latest design and the most finished construction.

A somewhat careful examination of papers shows that the instruction, in both theoretical and practical physics, is exceedingly careful and thorough.

We take pleasure in reporting the department in excellent condition.

ENGLISH STUDIES AND MODERN LANGUAGES.

Attending the actual examination of cadets in these departments as far as could be done, and reviewing the examination-papers, which the system of written examinations has greatly facilitated, the board are well pleased with the progress made, and commend the instructors, both for their methods and labors, and congratulate them and the cadets on their success and attainments. The intertranslation of English, French, and Spanish is heartily approved; the first being the commercial, and the second the diplomatic language of most of the world, and the Spanish being the language of our next-door neighbors to the south.

The attainments of cadets in United States history and international law are very commendable.

There seems to be nothing of importance in this department to criticise adversely, and therefore we express our satisfaction at its condition.

GROUNDS, BUILDINGS, AND SANITARY CONDITION.

The beauty and high degree of culture shown in the grounds of the academy are commendable, and so well known that a description is unnecessary. The residences are comfortable, and the quarters and buildings of the academy, including workshops and recitation-rooms, are kept in good repair, and, perhaps, are fully adapted to their several uses. Upon this subject, however, the board have some remarks and suggestions to make that are deemed important in the way of changes and improvements, most of which have been recommended by former boards, as essential to the growth, comfort, and future prosperity of the academy.

Upon the particular topic of quarters the board are informed that the present dormitory, or "new building," is not sufficiently large to accommodate *all* of the cadets, and the division of quarters, as now existing, necessitates a double amount of guards, watchmen, &c.; thus not only increasing expense, but lessening the efficiency of discipline. We, therefore, recommend that the new building be sufficiently enlarged, or the erection of another building, so that the entire body of cadets may be comfortably domiciled. We also especially urge, for well-known sani-

tary reasons, the immediate removal into a separate building of the kitchen, laundry, and store-rooms, now occupying the basement, or lower story of the cadet quarters.

The room for drawing, at the top or attic of this building, is unsuited for the purposes for which it is used, and is almost entirely without ventilation. The old quarters, now occupied by the first class cadet-midshipmen and all cadet-engineers, with little expense could be made useful for other purposes of the academy. The recommendation of former boards in regard to enlarging the work-shops for the classes of cadets in the department of steam-engineering is considered so patent that it is only necessary to refer to it again, and urge its adoption.

The present armory, which is built of wood, and is a mere shell, is totally inadequate to the purposes for which it is used. A suitable and substantial building should be erected in its stead, and this ought to be done without delay.

The board are aware that the various repairs and improvements herein recommended will require the action of Congress, and, through the Navy Department, desires to recommend such legislation as will fully carry out the important suggestions herein made.

The regulation of the Naval Academy prohibiting the use of tobacco, as a sanitary measure, is a wise provision, and, to use the language of Medical Inspector Gihon, in his well-digested report on this subject, the board are of opinion "that the regulations against the use of tobacco, in any form, cannot be too stringent; and, further, that while smoking should be wholly interdicted, special care should be exercised to prevent the substitution of chewing."

The board have carefully examined into the kind, quality, and cooking of the food furnished the cadets, and cheerfully bear testimony to the efficient management of the commissary of the Academy. This department of the administration of affairs is most successfully served.

The sanitary condition of the Academy is remarkably good; the hospital is a model of neatness and comfort, reflecting the ability and efficiency of its medical officers. The hospital has now no inmates, and the general health of the cadets is excellent.

The board are of the opinion that a more healthy-looking body of young men than the inmates of this institution cannot be found in the country.

FINANCE AND THE LIBRARY.

On financial matters there was strictly little or nothing to come under our notice. The board, however, looked into the operations of the business of the store, and found that it was conducted in an economical manner; the economy inuring to the benefit of the officers and the cadets.

The mode of keeping the accounts of the commissary was also investigated. We carefully scrutinized the method and arrangement of the accounts which have been instituted by the present commissary, Paymaster Kenny, and found them especially well adapted to the purpose. They are very precise and exact in their operation, and we think a better system could not possibly be devised.

The appointment of a naval officer to the position of commissary has resulted in a material improvement in the administration of the department and great saving in expenses to the cadets.

The library has become an important agent in the educational work of the Naval Academy. Its shelves are supplied with most valuable works on all the branches embraced in the course of instruction. Naval science and art, as well as naval history and biography, are well repre-

sented in the collection, as are also the abstract sciences, voyages and travels, general history, and literature. The value of the collection is enhanced by the possession of numerous publications of the leading scientific and professional bodies of Europe and America. In common with the superior officers, the cadets enjoy the use of the books. In recreation hours the latter may be seen in numbers in the various rooms of the library assiduously consulting authorities and taking notes on subjects assigned them for discussion by the instructors. In this laudable work they are encouraged by the academic staff. Thus habits of diligent research and study are cultivated, and the results, as might be expected, are found to be most beneficial. It is of importance now that an annual appropriation for the purchase of books adapted to the purposes of the institution be continued, so that valuable professional, scientific, and literary publications, as they issue from the press, may be added to the collection.

The board would also recommend that a number of the best technical periodicals devoted to practical steam-engineering be added to the library. These periodicals supply a very important want, and are of almost as great value in ordnance construction and iron steamship building as in engineering. They contain the current events in such departments as they occur, both at home and abroad, and are the only media through which information most necessary to the cadet-engineers can be obtained.

ADMINISTRATION AND POLICE.

The board having availed themselves of the unrestricted opportunities offered, have carefully considered these subjects, and find no powers claimed or exercised by the superintendent and corps of instructors which extend beyond the pale of proper authority, and the result of their discipline and teachings commends itself to our approval.

MISCELLANEOUS.

The board have considered the letter of Chief Engineer C. H. Baker, U. S. N., head of department of steam-engineering, with the letter of Rear-Admiral C. R. P. Rodgers, U. S. N., superintendent, accompanying.

After careful consideration of the matter contained in these letters, the board are of the opinion that the privileges asked for by Chief Engineer Baker ought not to be granted, and referring to the papers appended marked A and B.

THE NAVAL HOSPITAL AND GROUNDS.

The board, while recognizing that the naval hospital grounds are not attached to the Academy, though subject to the superintendent as the senior officer, feel that this valuable property should be carefully preserved, and make this new recommendation, that it should be attached directly to the Naval Academy and come entirely under the jurisdiction of its superintendent, with powers to rent, if advisable, part or parts of the land and to use the proceeds at his discretion for the care of the buildings and roads.

The board, learning with regret that the admiral, Superintendent C. R. P. Rodgers, is about to sever his connection with this institution, cannot conclude its report without stating its high appreciation of the rare executive ability with which he has discharged the delicate, difficult, and important trusts assigned him. His administration, conducted with

so much justice, moderation, and kindness as to command our warm approbation, leaves the Naval Academy in the highest state of efficiency.

JOHN L. WORDEN,
Rear-Admiral, President.
JEF. C. DAVIS,
U. S. A., Vice-President.
C. H. WELLS,
Captain, U. S. N.
DANL. S. PRINTUP,
Georgia.
C. M. WOODWARD,
Saint Louis, Mo.
ALEX. H. BROWN,
South Carolina.
ISAAC H. REED,
New York.
WM. H. PARKER,
President Maryland Agricultural College.
B. F. ISHERWOOD,
Chief Engineer, U. S. N.
G. W. T. WRIGHT,
Minnesota.
P. O. HOOPER, M. D.,
Arkansas.
K. R. BREESE,
Captain, U. S. N.
A. WHEELER,
Pennsylvania.

The Hon. SECRETARY OF THE NAVY.

A.

NAVAL ACADEMY,
Annapolis, Md., June 10, 1878.

SIR: The subject of this communication is one that does not fall within the scope of my official cognizance as head of a department at the Naval Academy, nor does it, under existing usages, come within the purview of the academic board. Nevertheless, I trust it will not be thought unbecoming if I venture to submit the following views to your consideration, that they may, if no objection exists, be laid before the board of visitors, now convened to witness the annual examination.

The cadet-engineers of the Academy now comprised in the first class have been withdrawn from the battalion of naval cadets, and are organized so as to compose a body called the engineer division. Some of them are designated cadet-engineer officers. Their positions are the analogous of those enjoyed by the cadet officers of the battalion, carrying with them the rank of the latter, but no official function of any importance. When other naval cadets are exercised in the outdoor drills of the battalion, and at great guns, the cadets of the engineer division, comprising, as I have said, only the cadet-engineers of the first class, are instructed and exercised in workmanship in the department of steam-engineering, that is to say, in the several arts of the machinist, the pattern-maker, the smith, &c., arts in which they will have received a great deal of instruction in those regular study periods of the day that are assigned to cadet-midshipmen of the first class in seamanship, naviga-

tion, and gunnery, and those hours in which cadet-midshipmen are exercised in seamanship and boat-drills.

I am aware of no good reason why the cadet-engineers of the first class should be removed from the established organization, and I believe the segregation to be pernicious and opposed to sound policy. I believe that it should be altogether discontinued, and the cadet-engineers be placed upon the same footing in the battalion with all other cadets. Exclusion from the honors paid to cadet-midshipmen distinguished in conduct and character would, it seems to me, produce a disheartening effect upon individuals among the cadets so excluded, and might curb that wholesome spirit of emulation which it is commonly thought wise to foster.

The cadet-engineers, as it seems to me, are practically so excluded; the offices bestowed upon these have no such significance as those enjoyed by cadet-midshipmen; practically, no authority pertains to them and no responsibility. Their special practical exercises in steam-engineering, being nothing more than instruction in hand-work, do not offer occasion for such relations as do the soldierly exercises of the battalion, and so the office held by the engineer cadet is little more to him than a star on the merit roll. The battalion is the corps in which the community of cadets appear as a unit to the outside world. The exclusion of the first-class men of the cadet-engineers from it and from the hope of office in it appears to me a discrimination that must be thought invidious until its necessity shall have been proved.

It may be argued that the distinction is analogous to that which necessarily obtains in the naval service between line officers and engineer officers, and is therefore justifiable between the cadets of the Academy, who in a manner represent the line and the engineers. But engineer officers have the importance of authority and responsibility in the nature of their duties, independent of the relative rank they have with the line. There seems to be no necessary analogy between the relations of the line and staff officers in the Navy and the cadet-midshipmen and the cadet-engineers of the Academy. The cadets are all in the Academy for the same purpose, and the needs of training and of discipline are for their career within the Academy rather than for the service at large.

If the discrimination is founded upon the circumstance that cadet-midshipmen alone pursue the study of infantry and light-artillery tactics, the remedy is easily applied to cadet-engineers who have had three years' *practical* instruction in these drills. The regulations of the Academy, issued January 1, 1876, provided for this branch of infantry tactics (article 107).

If it is founded upon the expectation that cadet-engineers, in their future career, will take no part in combat in such a way as that knowledge of arms might be of use to them, the expectation is not warranted by the experience of the naval service. Commanding officers have sometimes found circumstances to require or to justify the employment of engineer officers in the discharge of duties that must have been performed with the more facility and thoroughness if these officers had already acquired some knowledge of the arms and the art of the soldier.

If cadet-engineers of the first class are excluded from office in the battalion because it is assumed that the experience acquired by the cadet officers in the exercise of authority is an advantage more befitting cadet-midshipmen than cadet-engineers, because the former are at some time to have commands and the latter are not, it would seem that the nature of the duties of engineer officers afloat have not been accurately borne in mind. There is certainly a field of command in which the engineer officer never appears, and which is the exclusive province of the line officer;

but within the limits of his authority the former has the same need of those personal qualities of manhood that have ever been found essential to the naval officer, such as aptitude, nerve, fertility of resource, attributes always the better developed by training.

Whatever enhancement of the facility of command may result to a few line officers in the future from this exclusion of engineer-cadets from the battalion of the Academy, it may be dearly purchased at the cost of that depression of spirit that must result from needless discrimination against a class of men in whom the habits of thought and action that belong to naval officers are commendable and becoming.

If cadet-engineers of the first class are excluded from the battalion because it is thought the practice of workmanship is of greater value to them than the outdoor drills, the same reason would demand the exclusion of cadet-midshipmen as well.

But the outdoor exercises are of inestimable value to the cadets. It is this outdoor training that gives that admirable physical development which will not be overvalued if rated the most precious of the advantages the service has derived from the Naval Academy—the sound body, without which the sound mind was an impossibility.

If the development of physical excellence is of any importance to the engineer officer, it would seem wise to require participation in those outdoor exercises in which music and pageant are joined with movement and muscular exertion to such good purpose that even the civilian colleges of the country seek their aid in the abatement of those ills that study-rooms and work-rooms engender. They may well rely upon the stirring sights and sounds and the concerted movements of the battalion to quicken the pulses of the sedentary student. The legislature of the nation has offered the services of Army officers to the colleges for this instruction of the future lawyers, merchants, and mechanics of the country in the use of arms. It seems strange that in a great military school of the government a whole class of its students should be excluded from the benefits of such instruction.

I am led to believe, then, that the best interests of the naval service and of the naval cadets will be furthered by placing the cadet-engineers on the same footing in the battalion with other cadets, making the appointments to the positions of field, company, and non-commissioned officers upon some principle of selection that shall not exclude cadet-engineers of the upper classes, and that those of the first class be required to take these tours of duty with cadet-midshipmen of the first class as officers of the day, a duty from which they are excluded by the terms of article 362, Regulations of the Naval Academy.

I am, sir, very respectfully, your obedient servant,

CHARLES H. BAKER,
Chief Engineer, U. S. N.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent, &c., &c.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., June 13, 1878.

SIR: In compliance with Chief-Engineer Baker's request, I submit to the Board of Visitors the expression of his dissatisfaction with paragraph 160 of the Naval Academy Regulations, as amended by the Navy Department, upon the recommendation of the superintendent.

His views do not seem to me sound nor his points well taken. During

the first three years of a cadet-engineer's course, in order that he may have the physical exercise so desirable for growing lads, he joins the cadet-midshipmen in their infantry and artillery drills, and in the instruction in boxing, fencing, signals, and gymnastics. This is not so much to prepare him for his profession, as for the benefit of his health. In the last year the instruction becomes more strictly professional, and the cadets of the first class give greater attention and time to preparation for their naval careers.

The cadet-midshipmen who are to become instructors in military exercises afloat, and are to hold command in divisions of armed men, become the cadet-officers in military drills; while the cadet-engineers, who are to be employed in the management and construction of steam-engines, are required to do manual work in the machine and boiler shop, such as it will be their duty to direct in their service on board ship. This duty will not be the command of armed men, but the care of steam-engines and their manipulation. For such practical work an academic course presents few facilities, and it is especially to be desired that the young gentlemen serving as cadet-engineers shall acquire skill in the use of tools and the knowledge to be gained in workshops. They have chosen the honorable career of an engineer, and they are not likely to prepare for it too well in the limited time given to practical work at the Naval Academy. It might as well be demanded that when they graduate they shall be assigned service in the armed divisions of our ships of war, and perform the duties of the sea-officer on deck, as to insist that they shall be given command of divisions of small-arm men and gunners here in our daily drills. They hold equal rank with the cadet officers of the line, they share the advantages of the cadet-officers' table, they wear the same grade-marks, and they constitute a division, commanded by cadet-engineer officers, on equal terms with the cadet-midshipmen. I think the instruction in the use of tools and in repairing and refitting boilers and engines, which should be given them in our well-appointed shops during the last nine months of their cadetship, is of far more importance to them than the gratification of their desire to command divisions of guns or small-arm men—commands which will not fall to them hereafter in their naval service. Their dignity has, in my opinion, been sufficiently considered in forming the senior class into an engineer division, commanded and officered by cadet-engineers, with the rank and privileges of the other cadet officers. The cadet-engineers and cadet-midshipmen are on equal footing here, but their training for different careers is necessarily somewhat different.

With great respect,

C. R. P. RODGERS,
Rear-Admiral, Superintendent.

Rear-Admiral JOHN L. WORDEN, U. S. N.,
President Board of Visitors, Naval Academy.

B.

NAVAL ACADEMY,
Annapolis, Md., June 17, 1878.

SIRS: Your special committee appointed to consider the letter of Chief Engineer C. H. Baker, U. S. N., head of department of steam-engineering, with the letter of Rear-Admiral C. R. P. Rodgers, U. S. N., superintendent, accompanying it, beg leave to submit the following:

After careful consideration of the matter contained in these letters,

the committee are of the opinion that the privileges asked for by Chief Engineer Baker ought not to be granted, and for the reason substantially set forth in the letter of the superintendent, which we adopt as conclusive. It is our opinion that the cadet-engineers of the Navy were established with the view of meeting the growing necessities of the Navy in the particular department of steam-engineering and for those particular purposes only; and that it is unwise to depart from this for fear it may result in making their services less effective.

Your committee, however, do not see any objection to the cadet-engineers receiving such instruction in command as may be desired from the execution of any office of theirs in the department of steam-engineering, which is provided for in the General Order No. 98, of September 18, 1877, defining the titles and relative rank of the cadet-engineer, and believe such instruction could advantageously be bestowed, but to grant the request asked for would defeat the very purpose for which a cadet-engineer is intended.

Respectfully, your obedient servants,

DANIEL S. PRINTUP.
K. R. BREESE,
Captain, U. S. N.

The Hon. BOARD OF VISITORS.

CRUISE OF THE CONSTELLATION.

UNITED STATES PRACTICE-SHIP CONSTELLATION,
Off Naval Academy, Annapolis, Md., September 30, 1878.

COMMODORE: I have the honor to submit the following report of the practice-cruise of this vessel during the past summer:

I assumed command on the 24th July last, relieving Capt. James A. Greer. Two days later, 38 first class, 1 second-class, and 71 third-class cadet-midshipmen were received on board. Two other third classmen reported August 20, at New Bedford, making the total number of cadets during the summer 112.

July 29 I got under way and proceeded down the Chesapeake in tow of the United States steamer Fortune, passing out to sea on the last day of July. When the Fortune left us I shaped our course for New Bedford, Mass., arriving there August 3. Here you came aboard, your flag was hoisted, and the exercises commenced for your inspection. At the expiration of ten days your flag was hauled down on your leaving us at Newport, R. I.

During your stay we ran around to Oak Bluffs, Martha's Vineyard, for one day, to give the cadets an opportunity to visit that place, returning to Buzzard's Bay and cruising until the 14th of August, when we proceeded to Newport. Here the cadets visited the torpedo station for their instruction and information.

August 19 I returned with the ship to Buzzard's Bay and continued the instruction of the cadets until September 3, on which day I started for the Chesapeake Bay, arriving on the morning of the 7th. From this time until the 21st we exercised in the bay, and then came into Annapolis Harbor. Here the cadets stripped this ship and rigged the drill-ship Dale.

The cadets were landed on the morning of the 28th of September to commence their academic course, and the vessel went out of commission to-day.

During the cruise the first classmen have had, in succession, charge of the deck, performing the various evolutions of "tacking," "wearing," "boxhauling," "chappeling," "getting under way," and "anchoring."

They also, in succession, have performed the duties as officers of the forecastle, midshipman of the quarter-deck, mates of the gun and berth decks, and of the hold and hull.

They were stationed as captains of the various parts of the ship and did duty as seamen in handling the spars and sails.

They have been carefully instructed, both theoretically and practically, in the problems of navigation relating to finding the ship's position at sea, such as day-work, finding latitude and longitude from observations of the sun, moon, and stars; finding compass-errors by observations for azimuth and amplitude, and constructing deviation tables.

They were carefully instructed in the use of charts and the movements of the tides, and other minor matters relating to navigation.

The third class were arranged in five sections, and the sections placed in the immediate charge of the five watch and divisional officers, who at the end of each week examined and instructed them orally on the work of the past week.

They were required to keep seamanship note-books, which were commenced the day they came aboard. Weekly orders were issued fully explaining the work required. They contained directions for the cadets to give full explanations, in writing, of all the "standing rigging," how "fitted" and "set up," how all of the "running rigging" was "rove."

Sketches of this rigging, the "fife" and "pin" rails, "spars," "sails," "anchors," and other parts of the ship, were required.

They were also instructed in "heaving the lead," "steering," "knotting," "splicing," "fitting rigging," and in the duties required of topmen.

The conduct of the cadets has been good with a few exceptions, and the cruise, I believe, has been instructive and valuable, although we nave had one month less time than has been the custom for years.

In carrying out the work of the practice-cruise I have been greatly indebted to the untiring and thoughtful zeal of the executive officer, Lieut. Commander Charles V. Gridley, as well as to all my officers, who have been attentive and faithful in the performance of their duties.

I inclose, in duplicate, cruise reports of the professional aptitude, &c., of the cadet-midshipmen.

I am, sir, very respectfully, your obedient servant,

H. L. HOWISON,
Commander U. S. N., Commanding.

Commodore FOXHALL A. PARKER,
Superintendent United States Naval Academy, Annapolis, Md.

CRUISE OF THE MAYFLOWER.

UNITED STATES STEAMER MAYFLOWER (4th rate),
Annapolis Roads, September 28, 1878.

COMMODORE: In obedience to the order of your predecessor, I respectfully submit the following report of the practice-cruise of this vessel:

The cadet-engineers of the first and third classes were embarked on the 21st of June.

The vessel left Annapolis on the 24th of June, and the cruise closed on the 28th of September.

Table I shows the ports visited during the cruise.

TABLE I.

Name of port.	Date.	Name of port.	Date.
Norfolk, Va	June 25.	Providence, R. I	August 16.
New Castle, Del	June 30.	Newport, R. I	August 19.
Wilmington, Del	July 1.	Bristol, R. I	August 20.
Edgemoor, Del	July 4.	Providence, R. I	August 21.
Chester, Pa	July 5.	Newport, R. I	August 24.
League Island, Pa	July 11.	New London, Conn	August 28.
Philadelphia, Pa	July 12.	Cold Spring, N. Y	August 31.
New York, N. Y	July 19.	Newburgh, N. Y	September 2.
New London, Conn	July 22.	West Point, N. Y	September 3.
Boston, Mass	July 26.	New York, N. Y	September 5.
Oak Bluffs, Mass	August 8.	Washington, D. C	September 17.
New Bedford, Mass	August 10.	Annapolis, Md	September 19.
Newport, R. I	August 14.	Washington, D. C	September 21.
Bristol, R. I	August 15.	Annapolis, Md	September 28.

Table II shows the various establishments visited by the cadets while the vessel was at the different ports:

TABLE II.

Place.	Establishment.
Norfolk, Va	Navy-yard; dry-dock; machine-shops; Franklin, Galena, and Standish.
New Castle, Del	Tube Works of Morris, Tasker & Co.
Wilmington, Del	Harlan & Hollingsworth Co.'s.; Jackson Sharp & Co.; Sidell & Hastings; Lobdell Car Wheel Company.
Edgemoor, Del	Edgemoor Iron and Bridge Works.
Chester, Pa	John Roach & Sons.
League Island, Pa	Dictator and Quinnebaug.
Philadelphia, Pa	Baldwin Locomotive Works; Cramp & Sons; Hughes & Patterson's Rolling Mills; Empire Chain Works; Switch Back Railway, at Manch Chunk; Bethlehem Steel Works; Zinc Works; Prospect Coal Mine and Hazzard Manufacturing Company's Wire Works at Wilkesbarre, Pa.
New York, N. Y	Navy-yard; dry-dock; Powhatan and Tennessee.
New London, Conn	Naval station; Florida.
Boston, Mass	Navy-yard; rope-walk; wood-preserving process; Richmond; Wachusett; Massachusetts Institute of Technology; Norway Iron Works; Waltham Watch Factory; American Steam Gauge Company.
New Bedford, Mass	Twist Drill Works; Wamsutta Cotton Factory.
Newport, R. I	Torpedo Station.
Bristol, R. I	Herreshoff Manufacturing Company.
Providence, R. I	Providence Tool Company; Providence Steam Engine Company; Corliss Engine Company; American Screw Company; Hope Pumping Station; Brown & Sharp Tool Manufacturing Company; Nicholson File Company.
Cold Spring, N. Y	West Point Foundery.
Newburgh, N. Y	Greenwood Furnaces.
West Point, N. Y	Military Academy.
New York, N. Y	Delamater Iron Works; Morgan Iron Works; Chrome Steel Works; New York and Brooklyn bridge; American Institute Fair.
Washington, D. C	Navy-yard; foundery; copper-rolling mill, &c.

At all these places we were courteously received, and in many cases special machinery was set in operation for the benefit of the cadets.

Each cadet has been required to keep a journal in which to record his impressions of the various processes seen by him; these have been carefully and frequently read by the engineer officers, and at times by myself. Special mechanisms have, in addition, been sketched by the cadets.

Each cadet of the first class has been required to perform, in turn, the duties of machinist in the upper and lower engine-room, and each cadet of the third class has, in turn, stood watch in the fire-room while the vessel was under way.

The conduct of the cadets, with two exceptions which have been specially reported to you, has been in the main good.

I beg leave to call your attention particularly to the extreme kindness shown us by the Lehigh Valley Coal Company (through Mr. Israel W. Morris, their secretary), in furnishing us, free of all charge, a special car to conduct us to Bethlehem, Mauch Chunk, and Wilkesbarre, and thus affording to all a most rare and agreeable trip.

I also beg leave to call your attention to the utter unsuitability of this vessel for the purposes of the practice cruise; her accommodations for both crew and cadets are extremely limited; the steerages are so small that only two-thirds of the cadets have been on board, owing to the sheer inability of the vessel to stow the remainder; and of those on board some eight have been obliged to sleep in the hammock-boxes on deck, owing to insufficient ventilation in the lower steerage. Added to all this is the fact that the ordinary routine of a man-of-war cannot possibly be carried out, and the cadets leave the Academy with entirely erroneous impressions of the manner of carrying on duty on board ship.

I beg to make the following recommendations: That the visit to Wilmington be omitted; a vessel can anchor off Edgemoor, whence trains run to Wilmington (distant only three miles); that in addition to the engineer instructors, there be ordered an engineer officer who shall have charge of the machinery solely, and have nothing to do with the instruction of the cadets when in port; and that some arrangement be made by which the cadet-midshipmen of the first class may have an opportunity to visit some of the various establishments on the Delaware; an inspection of Roach's ship-yard and rolling-mill, and of the Bessemer-steel works at Bethlehem, alone, would be of the greatest assistance to them in the study of ship-building and ordnance in their first-class year.

A detailed report of the aptitude, conduct, &c., of the cadets is herewith inclosed.

Very respectfully, your obedient servant,

ALLAN D. BROWN,
Lieutenant-Commander, Commanding.

Commodore F. A. PARKER, U. S. Navy,
Superintendent United States Naval Academy, Annapolis, Md.

ESTIMATES FOR NAVAL ACADEMY.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., October 15, 1878.

SIR: I have the honor to transmit herewith, in duplicate, estimates for the support of the Naval Academy, for the fiscal year ending June 30, 1880.

I am, very respectfully, your obedient servant,

FOXHALL A. PARKER,
Superintendent.

Hon. R. W. THOMPSON,
Secretary of the Navy, Navy Department, Washington.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., October 15, 1878.

SIR: I have the honor to call the attention of the department to that portion of the naval appropriation bill for the fiscal year ending June

30, 1879, relative to the Naval Academy, by which it will be perceived that while Congress made specific appropriations for it under the several heads of appropriation, the summing up of the amounts under three of these heads does not agree with the actual amounts named in the bill as appropriated, viz:

"Pay of professors and others"	$52,518 00
Should be	52,526 00
"Pay of watchmen and others"	24,080 75
Should be	24,180 75
"Pay of mechanics and others"	16,115 95
Should be	16,835 95

Making a difference to the Academy of $728.

Believing it the intention of Congress to give us the amounts named in the bill, I have, in submitting the estimates for the fiscal year ending June 30, 1880, been governed in their preparation by the specific amounts appropriated under the several heads of appropriation, and not by the erroneous summing up of them.

I am, very respectfully, your obedient servant,

FOXHALL A. PARKER,
Superintendent.

Hon. R. W. THOMPSON,
Secretary of the Navy, Navy Department, Washington.

Estimates for the support of the United States Naval Academy, for the fiscal year ending June 30, 1880.

Object of expenditure.	Estimated amount.
PAY OF PROFESSORS AND OTHERS.	
One professor of modern languages (head of department)	$2,500 00
One professor of drawing (head of department)	2,500 00
Three professors, viz: one of physics, one of chemistry, one of Spanish, assistants, at $2,200 each	6,600 00
Seven assistant professors, viz: four of French, two of English studies, history and law, one of drawing, at $1,800 each	12,600 00
Sword-master, at $1,500, and two assistants, at $1,000 each	3,500 00
Boxing-master and gymnast	1,200 00
Assistant librarian	1,400 00
Secretary	1,800 00
Three clerks to superintendent, at $1,200, $1,000, and $800 each	3,000 00
One clerk to commandant of cadets	1,000 00
One clerk to paymaster to audit cadets' accounts	1,000 00
One apothecary	750 00
One baker	600 00
One mechanic in department of physics and chemistry, making and repairing instruments and apparatus	600 00
One mess-man, at $288; one cook, at $325.50; and messenger to superintendent, at $600	1,213 50
One armorer, at $529.50; gunner's mate, at $469.50; and quarter-gunner, at $409.50	1,408 50
One coxswain for gymnasium, at $469.50; one seaman in department of seamanship, at $349.50; one seaman in department of astronomy, &c., at $349.50; one seaman in department of physics and chemistry, at $349.50	1,518 00
One bandmaster, at $528, and 21 first-class musicians, at $348 each	7,836 00
Seven second-class musicians, at $300 each	2,100 00
	53,126 00
Amount appropriated under this head, "pay of professors and others," for the year ending June 30, 1879	52,526 00
Excess	600 00
NOTE.—This excess is occasioned by the enlargement of the laboratory, rendering necessary the addition of one mechanic in the department of physics and chemistry to repair instruments and construct simple apparatus.	
PAY OF WATCHMEN AND OTHERS.	
Captain of the watch and weigher, at $2.50 per diem	912 50
Four watchmen, at $2 per diem each	2,920 00
Foreman of the gas and steam-heating works of the Academy, at $5 per diem	1,825 00

Estimates for the support of the United States Naval Academy, &c.—Continued.

Object of expenditure.	Estimated amount.
PAY OF WATCHMEN AND OTHERS—Continued.	
Ten attendants at gas and steam-heating works—one at $3, one at $2.50, and eight at $2 per diem each	$7,847 50
One steam-pipe fitter, at $2 per diem	730 00
One foreman of joiners, one foreman of painters, and one foreman of masons, at $3.50 per diem each	3,832 50
Two joiners, one painter, and one mason, at $2.50 per diem each	3,650 00
One tinner, one gas-fitter, one blacksmith, at $2.50 per diem each	2,737 50
	24,455 00
Amount appropriated for the year ending June 30, 1879	24,180 75
Excess	274 25
NOTE.—This excess is occasioned by an increase of twenty-five cents per day to the "captain of the watch," who also performs the responsible duty of weigher; and an increase of about fifty cents per day to the steam-pipe fitter, whose services are constant and laborious.	
PAY OF MECHANICS AND OTHERS.	
One mechanic at workshop, at $2.25 per diem	821 25
One master laborer to keep public grounds in order, at $2.28 per diem	832 20
Fourteen laborers to assist in the same, three at $2 and eleven at $1.50 per diem each	8,212 50
One laborer to superintend quarters of cadets, public grounds, &c., at $2 per diem	730 00
Six attendants: one at chapel, one at recitation hall, one at offices, one at library, one at paymaster's office, and one at store, at $20 per month each	1,440 00
Twenty servants, to keep in order and attend to cadets' quarters, public buildings, &c., at $20 per month each	4,800 00
	16,835 95
Amount appropriated for the year ending June 30, 1879	16,835 95
PAY IN DEPARTMENT OF STEAM-ENGINEERING.	
One master machinist, at $3.50 per diem	1,277 50
One boiler-maker, at $3.50 per diem	1,277 50
One pattern-maker, at $3.50 per diem	1,277 50
Two machinists, at $2.50 per diem	1,825 00
One blacksmith, at $2.50 per diem	912 50
One molder, at $2.50 per diem	912 50
Two laborers, at $1.50 per diem each	1,095 00
	8,577 50
Amount appropriated for the year ending June 30, 1879	7,665 00
REPAIRS AND IMPROVEMENTS.	
For the necessary repairs of public buildings, pavements, wharves, and walls inclosing the grounds of the Naval Academy, for improvements of the same, and for furniture, fixtures, &c	21,000 00
Appropriated for the year ending June 30, 1879	21,000 00
HEATING AND LIGHTING.	
For fuel for heating and lighting the Academy and school-ships	17,000 00
Appropriated for the year ending June 30, 1879	17,000 00
CONTINGENT EXPENSES.	
Naval Academy.	
For the purchase of books for the library	2,000 00
For stationery, blank-books, models, maps, &c., and for text-books for the use of instructors	2,000 00
For the expenses of the board of visitors	3,000 00
For the purchase of chemicals, apparatus, and instruments in the department of physics and chemistry, and for the repairs of the same	2,500 00
For the purchase of gas and steam machinery, steam pipe and fixtures, rent of buildings for the use of the Academy, freight, cartage, water, music, musical and astronomical instruments, uniforms for the bandsmen, telegraphing, and for the feed and maintenance of teams, and for the current expenses and repairs of all kinds, and for incidental labor and expenses not applicable to any other appropriation	34,600 00
For stores in the department of steam-engineering	800 00
For materials for repairs in steam-machinery	1,000 00
	45,900 00
Appropriated for the year ending June 30, 1879	45,500 00
Excess	400 00
NOTE.—This increase for the expenses of the board of visitors is deemed necessary to cover the allowance of eight cents per mile prescribed by law for each member of the board, instead of actual and necessary traveling expenses, as heretofore.	

RECAPITULATION.

Pay of professors and others	\$53,126 00
Pay of watchmen and others	24,455 00
Pay of mechanics and others	16,835 95
Pay in department of steam-engineering	8,577 50
Repairs and improvements	21,000 00
Heating and lighting	17,000 00
Contingent expenses	45,900 00
Amount estimated for	186,894 45
Appropriated for year ending June 30, 1879	184,707 70
Excess	2,186 75

Respectfully submitted.

FOXHALL A. PARKER,
Superintendent.

Hon. R. W. THOMPSON,
Secretary of the Navy, Navy Department, Washington, D. C.

No. 3.—BUREAU OF EQUIPMENT AND RECRUITING.

NAVY DEPARTMENT,
BUREAU OF EQUIPMENT AND RECRUITING,
Washington, October 1, 1878.

SIR: I have the honor to submit herewith the annual report of the operations of this bureau for the past fiscal year, together with estimates for its support for the fiscal year ending June 30, 1880.

During the past fiscal year 63 vessels have been either wholly or partially equipped at the several navy-yards, at an expenditure of \$717,010.36, as follows: For labor, \$142,205.21; for material from stock on hand, \$487,675.81; for material purchased during the year, \$87,129.34.

Thirty-six thousand seven hundred and eighty tons of coal have been purchased at home and abroad for use of the Navy, under cognizance of this bureau, costing, including freight, \$288,222.09.

Two hundred and eighty thousand five hundred and thirty pounds of manila hemp have been purchased, costing \$23,857.54.

There has been expended under appropriation "Equipment of vessels, 1878," during the year, \$644,668.80, as follows: for labor in the several navy-yards, \$298,140; for coal, hemp, and other articles of equipment at home and abroad, \$346,528.80—leaving a balance on hand July 1, 1878, of \$225,331.20, from which is to be paid an outstanding indebtedness of \$90,000.

Under appropriation "Contingent equipment and recruiting, 1878," there has been expended \$51,452, leaving a balance on hand July 1, 1878, of \$13,542.

The bureau has made no contracts during the year, the supplies needed from time to time, as exigencies arose, having been procured by advertisement for proposals as the law directs.

GALLEYS.

All the galleys needed for the Navy have been manufactured at the Washington navy-yard, with Young's patent improvements. A new coffee-boiler has also been attached to the galleys for making coffee for the crew, to take the place of the old method of merely pouring hot water over the coffee in a mess-kettle, when very little of the strength or good of the coffee was obtained. The coffee made in this boiler is found to be superior in strength to that made in the mess-kettle, in the ratio of three to two. As recommended by the bureau, all single-deck vessels that have been recently equipped have had their galleys placed under

the topgallant forecastle, which has added much to the comfort of the crew in removing this great source of heat from the berth-deck.

FURNITURE FOR OFFICERS' MESSES.

The bureau has instituted boards at the several navy-yards with a view of establishing a standard of quality and price for the purchase of carpets, oilcloth, curtain material, &c., for use in the Navy.

New allowances of crockery, glass, and plated ware have been made for officers' messes and state-rooms, but in this connection the bureau recommends that a more durable kind of crockery and glassware be substituted for the expensive and fragile kind at present in use in the Navy.

WATCH, QUARTER, AND STATION BILLS.

A great need of the service, in order to have uniformity in the stationing of the crews of vessels and the exercises on board ship, has been supplied by this bureau during the past year, in a uniform watch, quarter, and station bill, applicable to all classes of vessels.

This has been printed, and will be furnished to all vessels placed in commission.

IRON-ROLLING MILL.

Since the date of my last report, an iron-rolling mill has been put in operation at the Washington navy-yard, at total cost of $9,953.23.

This rolling-mill will be able to furnish all of the round, bar, and flat iron required for use at the several navy-yards, and will be an economy to the government, in utilizing all of the accumulated wrought-iron scraps at the several yards, and furnishing material at reduced cost.

WIRE BOARD.

The board for testing iron and steel wire for the manufacture of ropes and hawsers has completed its tests of all the various kinds of wire submitted. This work has been performed with the greatest care, and the board feels assured that its accuracy can be relied upon. The number and variety of specimens is large; the conclusions being deduced from the testing of some 2,320 specimens, comprising 17 varieties of steel, and 15 varieties of iron wire.

Since August 1 the board has been preparing to have those varieties of wire made into rope which from the results of the experiments were deemed most suitable for the different purposes required of wire rope, and then tested in the form, and as nearly as possible under the conditions, in which it is to used, in order to judge whether the opinions formed from the tests (as a single wire) in regard to its value for a certain purpose will be sustained under the new conditions. This, with a few experiments relating to the most desirable pitch of strand per foot, will close the work of the board; and a final report will be made, which they hope will afford valuable information to others besides those especially interested.

ANCHORS.

The bureau has sought to find some kind of an anchor to do away with the large and crude one in present use. So far, the "Martin non-fouling anchor" (an English patent) seems to meet most of the requirements, but it is to be hoped that our American talent for invention will not let this matter remain dormant.

VENTILATION.

The subject of ventilation of our ships, so much needed, has been under the consideration of a board of officers, detailed by the department. All of the most modern and advanced plans for ventilation were carefully studied, and a plan for the ventilation of the Richmond was submitted.

This plan has been carried out in the Richmond, and consists of a series of pipes and conduits running to every part of the ship, and leading to an exhaust-fan, run by steam, or which can also be run by hand-power. One of the most important suggestions given by the board was the necessity of larger air-ports. The improved air-port, which has an air-space of just twice the old one, has been put in the Richmond and Shenandoah.

This latter improvement should be placed in every ship. This system of ventilation should be given a trial in the Richmond, and I am sure the health and efficiency of the crew will soon show that something of the kind was greatly needed.

CONDUCT REPORTS.

The "conduct reports" to this bureau continue to exhibit a marked improvement in the conduct of the enlisted men of the Navy.

On the 30th of June, 1877, there were 6,106 men afloat, distributed upon 61 vessels, upon whom, during the last quarter of that year, there were 1,366 punishments inflicted, or 22 per cent.; while on the 30th of June last there were 6,135 men afloat upon 59 different vessels, upon whom were inflicted 864 punishments, or 12 per cent., showing a decrease of 10 per cent.

As naturally following the *morale* of the enlisted men, I am pleased to state that the number of desertions during the last fiscal year was only 669; during the previous year 818, showing a decrease of 149. Two years since the report of desertions showed 1,203, making a decrease of nearly 50 per cent. in desertions.

HONORABLE DISCHARGES AND CONTINUOUS-SERVICE CERTIFICATES.

During the last fiscal year 210 men were recommended and received "honorable discharges," and three "medals of honor" were issued: Antonio Williams, seaman, for "courage and fidelity" displayed at the time of the loss of the Huron; William Anderson, coxswain, United States ship Plymouth, while at New York, for rescuing from drowning W. H. Moffat, first-class boy; and Henry Thompson, seaman, United States ship Pensacola, at Mare Island, for rescuing a man from drowning.

Three thousand and fifty-two continuous-service certificates have been issued to the Navy, 387 of which have been issued since last report. June 30, 1878, there were 863 continuous-service men in the Navy, who reenlisted under said certificates and availed themselves of the benefits thereof.

TRAINING SYSTEM.

Five hundred and twenty-three boys have been enlisted during the past year under section 1418 Revised Statutes of the United States.

There are remaining on the training-ships 440, viz: On the Minnesota 272, on the Saratoga 121, and on the New Hampshire 47. Of this number, 70 have been detailed for the Richmond and 71 for the Quinnebaug.

Four hundred and forty-five boys are serving on cruising vessels, having passed into the general service, viz: Alaska, 28; Adams, 60; Con-

stellation, 41; Essex, 63; Enterprise, 16; Hartford, 68; Marion, 17; Monongahela, 41; Portsmouth, 33; Plymouth, 17; Trenton, 41; Tallapoosa, 10; Wyoming, 10. Twenty-six of the above number are under training for the engineers' force of the Navy, and are distributed as follows: Alaska, 8; Tallapoosa, 10; Wyoming, 8.

To show that these boys are doing their duty, and are advancing the tone and *morale* of the service, I append extracts from reports of commanding officers, in reply to a letter of this bureau, dated September 11, 1878, as evidence of their good conduct and efficiency.

Captain Luce, of the Minnesota, says:

I have the honor to state that the general character of the boys is excellent, and in the great majority of cases their aptitude for the naval service is all that could be desired.

By reports received from vessels on foreign stations, to which drafts of these boys have been sent, it is found that they fulfill every reasonable expectation, and give promise of future usefulness to the service.

It needs but the placing of the training system on a permanent basis to insure in a very few years the manning of our ships by native-born seamen, and the benefits of the system to the national marine cannot but react favorably on the mercantile marine.

Captain Greer, of the Constellation, says:

I observed a spirit of pride to improve prevailed among them. They were instructed in steering and in a knowledge of the lead and compass; also, knotting and splicing. In addition, they had much experience aloft and in assisting in the working of the ship. A large proportion showed a marked aptitude for the service.

It is with pride that I bear testimony to their promise of usefulness, and of amply repaying the government for the pains and expense incurred in preparing them for the Navy. I would prefer a detail of the enlisted boys to the landsmen and many of the ordinary seamen, as formerly allowed.

Captain Fitzhugh, of the Monongahela, says:

The conduct of the boys on board this vessel will compare with that of the same number attending the public schools in any community on shore, if not superior, considering the temptations that are thrown in their way and absence of parental control. Few or none of the offenses committed by them are of a vicious nature, generally being such as would be expected among boys of their age. Drunkenness is unusual. They are, as a general thing, equal to the average ordinary seaman.

Commander Watson, of the Wyoming, says:

The general conduct of the boys on board the Wyoming, in training for the engineers' force, has been most excellent, and their aptitude for the naval service good. They are intelligent, attentive to instruction, and are interested in their specialty.

Lieutenant-Commander Evans, of the Saratoga, says:

I consider the general character of the boys on board this vessel as excellent. In arriving at this conclusion, I compared them morally, mentally, and physically with the ordinary seamen and landsmen on board other vessels in which I have served. As regards their aptitude for the service, I am entirely satisfied that a very large percentage of them will be rated as seamen and ordinary seamen as soon as they have been long enough in the ships to which they are transferred to master their peculiarities of rig, &c. I am confident that if the system inaugurated in these training-ships be faithfully followed in the service, we will, in a few years, have an excellent set of well-bodied, well-educated American seamen.

Of the ten boys on board the Tallapoosa under training for the engineers' force, Lieutenant McRitchie says:

These boys have been brought to a high state of perfection in their duties in the fire and engine rooms. Their behavior is good, and in my opinion they are well adapted for the naval service. The placing of boys on this vessel, so actively employed, and the fact of visiting so many navy-yards, where they have the opportunity of seeing so many types of engines, will, I am sure, result in great good to them, and will be a benefit to the service in years to come.

If it is the intention of the department to continue the present system of training-ships, with the aid of legislation by Congress, I would respectfully recommend that the sailing-vessels Constitution, Saratoga,

and Portsmouth be retained for that purpose. These vessels are among the last of our sailing-vessels, and are peculiarly adapted to the purpose of training the boys in the handling of sails and bringing them to a knowledge of seamanship. I would recommend that during the winter the Constitution be stationed at New York, the Portsmouth at Philadelphia, and the Saratoga at Baltimore, or at such other ports as the department may direct, and that during the summer these vessels should combine for a cruise and exercise in our own waters, under the command of the senior officer.

RECEIVING-SHIPS.

The system inaugurated by the department of having certain of our ships in reserve for sea-service in preference to old hulks, as rendezvous for recruits at the naval stations, should be extended. As the Wabash is at Boston, the Colorado at New York, and the Franklin at Norfolk, I would recommend that the Minnesota be stationed at League Island as a receiving-ship and marine barracks.

CONCLUSION.

As this report will close the administration of the present chief of bureau, he takes the occasion to express the gratification he has felt in observing the gradual but marked improvement in the moral and professional character of the enlisted men of the Navy.

Within the last three years, desertion, that cancer which in the course of time will destroy the life of any military body, has been reduced fifty per cent., and punishments have indicated, by their diminution, a steady purpose on the part of the men to obey the law.

There is no more reason why a sailor should run away from his ship than a blacksmith from his anvil. Remove the cause first; punish the act afterward. There is a field of usefulness here to any officer in charge of this bureau, or in command of any of the recruiting stations, who is willing to step outside of the conservatism of rank and take an interest in the welfare of the "common sailor."

In Japan, the youngest in the family of civilized nations, the soldier is regularly taught in schools established by the government. There, at least, the fact seems to be recognized that the *personnel* of a military body to be efficient must be intelligent.

In this connection the chief of the bureau commends to his successor the apprentice boys of the Navy; these wards of the government, who come from the rank and file of the country, are the future guardians of the nation's honor among the other nations of the earth. Say what you will, the efficiency of the Navy depends upon its officers and men and not upon its ships and guns. The latter change with every fashion or whim of the day; the former remain the same, and will as long as human nature endures.

The honorable Secretary of the Navy has always sustained the efforts of his subordinates in the promotion of the welfare of the seaman; unfortunately, Congress has not always heeded his recommendations; but after all, the steady growth of improvement must depend upon the officers of the Navy, who, by virtue of their position, are the teachers of the men.

Very respectfully, your obedient servant,

R. W. SHUFELDT,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Bureau of Equipment and Recruiting.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES, BUREAU OF EQUIPMENT AND RECRUITING.		
Chief clerk (per Rev. Stat., p. 69, sec. 416, and per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	$1,800 00	
One clerk of class four (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	1,800 00	
One clerk of class three (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	1,600 00	
Two clerks of class two (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	2,800 00	
Two clerks of class one (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	2,400 00	
One assistant messenger (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	720 00	
One laborer (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	660 00	
Total	11,780 00	$11,780 00
CONTINGENT, BUREAU OF EQUIPMENT AND RECRUITING.		
For stationery, books, and miscellaneous items (per act June 19, 1878, 20 Stat. at L., p. 197, sec. 1)	500 00	500 00
EQUIPMENT OF VESSELS.		
Coal for steamers' and ships' use, including expenses of transportation, storage, and labor; hemp, wire, and other materials for the manufacture of rope; hides, cordage, canvas, leather; iron for the manufacture of cables, anchors, galleys, and chains; furniture, wood, bake-ovens, and cooking-stoves, boat-detaching apparatus, life-rafts, and hose; heating apparatus for receiving-ships; and for pay of labor in equipping vessels and manufacture of equipment articles in the several navy-yards (per Rev. Stat., p. 738, secs. 3709, 3747; appropriated, 20 Stat. at L., p. 52, sec. 1)	800,000 00	800,000 00
CONTINGENT, BUREAU OF EQUIPMENT AND RECRUITING.		
Expenses of recruiting and fitting up receiving-ships; freight and transportation of stores; transportation of enlisted men; printing, advertising, telegraphing, books and models, stationery, express charges; internal alterations, fixtures and appliances in equipment-buildings at the several navy-yards; foreign postage, car-tickets, ferriage, ice; apprehension of deserters; assistance to vessels in distress; continuous-service certificates and good-conduct badges for enlisted men, including purchase of school-books for training-ships (per Rev. Stat., p. 726, sec. 3666; appropriation, 20 Stat. at L., p. 52, sec. 1)	50,000 00	50,000 00
CIVIL ESTABLISHMENT, BUREAU OF EQUIPMENT AND RECRUITING.		
Appropriated (19 Stat. at L., p. 386, sec. 1):		
Navy-yard, Kittery, one clerk	1,300 00	
Navy-yard, Boston:		
One superintendent of rope-walk	1,800 00	
One clerk	1,400 00	
One clerk	1,300 00	
One writer	1,017 25	
Navy-yard, New York:		
One clerk	1,400 00	
One clerk	1,300 00	
Navy-yard, League Island, one clerk	1,300 00	
Navy-yard, Washington:		
One clerk	1,400 00	
One clerk	1,300 00	
One writer	1,017 25	
Navy-yard, Norfolk, one clerk	1,300 00	
Navy-yard, Pensacola, one writer	1,017 25	
Navy-yard, Mare Island, one clerk	1,400 00	
Total	18,251 75	
NOTE.—$150,000 was appropriated in gross for the civil establishment at all the navy-yards for the fiscal year 1879.		

No. 4.—BUREAU OF ORDNANCE.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington City, October 10, 1878.

SIR: I have the honor to submit the annual report of this bureau, with accompanying detailed estimates for the fiscal year ending June 30, 1880.

ESTIMATES.

1. Labor, tools, material, and fuel used in fitting ships for service, and preservation of ordnance and ordnance-stores	$175,000 00
2. Repairs to buildings, magazines, wharves, gun-parks, tugs, lighters, and boats	50,000 00
3. Torpedo service	45,000 00
4. Miscellaneous items, freight, telegrams, postage, advertising, &c	3,000 00
5. Civil establishment at navy-yards	11,886 25
Total	284,886 25

These estimates conform to the appropriations made for the fiscal year of 1878–'79, simply based upon the necessities of the current service of fitting ships for sea, and do not admit of any progress being made in supplying new and improved ordnance.

CANNON.

Great progress has recently been made abroad in developing the power of artillery, rendering the attack far superior to the defense, and detracting very much from the value of armored ships, since any ship now built or building can be pierced by guns of the moderate caliber of 12 inches. All these improvements inure to our benefit, as we have our whole artillery to reconstruct.

The bureau is prepared, whenever an appropriation shall be made, to supply the designs for guns quite equal to any of which we have notice.

All these experiments appear to confirm the views of the chief of bureau, that the rifle-cannon adopted should be a breech-loader, and the latest and most successful experiments have been with guns fitted with the screw-breech, or French plan, which has commanded the preference of the chief of this bureau.

GUNPOWDER.

A large part of the increased effects with the new guns is due to the improved powder adopted. From the published results, this progressive powder does not appear to be superior to the United States standard navy powder which was adopted in 1874, after a careful series of experiments made by the late Commander J. D. Marvin; and the bureau feels quite certain that it can reproduce any desired result.

The stock of powder has fallen very low, and a special appropriation should be made for the purchase of 4,000 barrels.

The new powder cannot be manufactured in haste, nor to advantage in the winter season of the year. Time is therefore required, and a stock should be kept on hand to meet emergencies.

MACHINE GUNS.

Several of these have been presented for trial, but possess no particular value over those already in use.

Improvements have been made in the Gatling and Lowell battery guns, both of which are in use in the Navy; but not sufficiently marked as to necessitate any change of those we have.

SMALL-ARMS.

The Army board on small-arms has made a favorable report on and recommended for adoption the Hotchkiss magazine gun.

While a magazine gun is, perhaps, more required for the Navy than for the Army, it is desirable that we should await the issue of this arm to troops and its actual test in service before adopting it, as the change of caliber would throw out of service all our machine guns as well as the small-arm in use. Therefore, while it is very desirable we should adopt the same caliber as the Army, and also that we should have a magazine gun, I do not think it expedient to make any immediate change.

TORPEDOES.

The torpedo station, under command of Capt. K. R. Breese, has graduated the usual number of officers, and with the very limited means at its command practically investigated the subject of electric lighting as applicable to the defense against torpedoes, the experiments in countermining, and the clearing away of torpedoes.

Last year, however, was quite barren in torpedo results. Notwithstanding the war in the East the offensive developments have been very small.

Our distinguished citizen and inventor, Capt. John Ericsson, has been for some months engaged in the construction of a vessel which bids fair to be a new step in advance in offensive warfare. The vessel is now near completion, and I am expecting very shortly a trial trip will be made and she will prove a great success; a full report of which will be submitted.

HOTCHKISS REVOLVER CANNON.

The Hotchkiss revolver cannon ordered by the bureau some two years ago has recently been received. The special advantages of this gun are, that while it fires a shell of a pound weight with a high velocity, it is pointed from the shoulder, thus enabling a veritable field-piece to be fired with all the accuracy of, and a much greater rapidity than, the rifle small-arm. Its caliber is 37 millimeters ($1\frac{1}{2}$ inches); has five barrels; total weight of 200 kilograms (440 pounds); shell of one pound, which bursts into from fifteen to nineteen pieces; has an accuracy at 3,000 yards equal to that of the ordinary rifle cannon; it can be fired at the rate of fifty shots per minute, and, pointing with care, from thirty to forty shots. It penetrates at a thousand yards any of the modern torpedo boats, such as the Thornycroft's; after passing through the side the fragments have sufficient force to penetrate the water-tight bulkheads. The above data are taken from official reports.

It would appear, then, that we have in this arm an absolute defense against surface torpedo boats, and, except in circumstances of fogs or darkness, no surface torpedo boat can approach within 1,000 yards of a vessel provided with these guns. This gun would also be extremely valuable for the purpose of firing into the open ports of ships, or for clearing the parapets of barbette guns.

The Chief of Bureau, therefore, recommends an appropriation for the purchase of a number for actual trial in service.

The bureau appends certain papers for the information of the service.

I am, very respectfully, your obedient servant,

WILLIAM N. JEFFERS,
Commodore, Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Bureau of Ordnance, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.		
Chief clerk (Rev. Stat., p. 70, sec. 416; act June 19, 1878, p. 197, sec. 1)	$1,800 00	
Draughtsman (Rev, Stat., p. 70, sec. 416; act June 19, 1878, p. 197, sec. 1)	1,800 00	
One clerk of class three (Rev. Stat., p. 26, sec. 167; act June 19, 1878, p. 197. sec. 1).	1,600 00	
One clerk of class two (Rev. Stat., p. 26. sec. 167; act June 19, 1878, p. 197, sec. 1.	1,400 00	
One assistant messenger; act June 19, 1878, p. 197, sec. 1	720 00	
One laborer; act June 19, 1878, p. 197, sec. 1	660 00	
	7,980 00	$7,980 00
CONTINGENT.		
Stationery, books, and miscellaneous items (appropriated)	400 00	400 00
ORDNANCE AND ORDNANCE STORES.		
Fuel, tools, and material of all kinds necessary in carrying on the current daily work of mechanical branches of the ordnance department of the several navy-yards, magazines, and stations (appropriated act May 4, 1878)	50,000 00	
Labor at the several navy-yards, magazines, and stations, in fitting ships for sea, and in preserving ordnance material (appropriated act May 4, 1878)	125,000 00	
Necessary repairs to ordnance buildings, gun-parks, magazines, boats, lighters, wharves, machinery, and other necessaries of the like character (appropriated act May 4, 1878)	50,000 00	
Miscellaneous items, to wit: Freight to foreign and home stations; advertising, and auctioneer's fees; cartage, and express charges; repairs to fire-engines, gas and water-pipes; gas and water-tax at magazines; toll, ferriage, foreign postage, telegrams, &c. (appropriated act May 4, 1878)	3,000 00	
	228,000 00	228,000 00
CIVIL ESTABLISHMENT.		
At navy-yard, Portsmouth, N. H.:		
One clerk (appropriated act May 4, 1878)	1,300 00	
At navy-yard, Boston, Mass.:		
One clerk (appropriated act May 4, 1878)	1,400 00	
At navy-yard, Brooklyn, N. Y.:		
One clerk (appropriated act May 4, 1878)	1,400 00	
One writer (appropriated act May 4, 1878)	1,017 25	
At navy-yard, League Island, Pa.:		
One writer (appropriated act May 4, 1878)	1,017 25	
At navy-yard, Washington, D. C.:		
One clerk (appropriated act May 4, 1878)	1,400 00	
One writer (appropriated act May 4, 1878)	1,017 25	
At navy-yard, Norfolk, Va.:		
One clerk (appropriated act May 4, 1878)	1,300 00	
At navy-yard, Pensacola, Fla.:		
One writer (appropriated act May 4, 1878)	1,017 25	
At navy-yard, Mare Island, Cal.:		
One writer (appropriated act May 4, 1878)	1,017 25	
	11,886 25	11,886 25
NOTE.—$150,000 was appropriated in gross for the civil establishment at all the navy-yards for the fiscal year 1879.		
TORPEDO CORPS.		
Labor (appropriated act May 4, 1878)	15,000 00	
Material (appropriated act May 4, 1878)	10,000 00	
Freight and express charges (appropriated act May 4, 1878)	500 00	
Repairs to grounds, buildings, wharves, boats, &c., (appropriated act May 4, 1878)	5,000 00	
Instruction, and general torpedo experiments (appropriated act May 4, 1878)	14,500 00	
	45,000 00	45,000 00

Respectfully submitted.

WILLIAM N. JEFFERS,
Commodore, Chief of Bureau.

Manufactures and preparations at the various navy-yards for the year ending June 30, 1878.

ARTICLES UNDER PROPORTION TO EACH GUN.

13 8-inch M. L. R. carriages, altered from XI inch.
10 sets M. L. R. sights, complete.
18 M. L. R. central-sight bars.
23 M. L. R. side-sight bars.
24 M. L. R. side-sight boxes.
25 M. L. R. rim-base sights.
25 M. L. R. sight thumb-screws.
100 M. L. R. sight side screws.
3 M. L. R. carriage-extension pieces.
12 M. L. R. shell-loaders.
1 M. L. R. transporting axle and trucks.
20 M. L. R. trunnion-eccentrics.
22 M. L. R. rammers.
19 M. L. R. shell-extractors.
12 M. L. R. pivot-bolts.
1 set M. L. R. gun-gripes.
57 M. L. R. gun-tackles.
12 M. L. R. sponges, woolen.
18 M. L. R. sponge-covers, woolen.
14 M. L. R. sponge-caps, canvas.
6 M. L. R. muzzle-bags.
5 M. L. R. passing-boxes.
106 M. L. R. rifle canister.
5 M. L. R. vent impression takers.
5 M. L. R. sponges, bristle.
1 80-pounder B. L. R. top-carriage.
1 80-pounder B. L. R. rifle plug.
1 80-pounder B. L. R. circulating-pump.
50 80-pounder B. L. R. canister.
1 80-pounder B. L. R. face-plate.
2 80-pounder B. L. R. Broadwell rings.
2 XI-inch breechings.
4 XI-inch preventer breechings.
3 XI-inch woolen sponges.
14 XI-inch woolen sponge-covers.
3 XI-inch shell-bearers.
4 XI-inch muzzle-bags.
1 set XI-inch gun-gripes.
3 XI-inch tompions and wads.
20 XI-inch shell-boxes.
1 XI-inch scraper.
11 XI-inch rammers.
1 XI-inch vent impression taker.
10 XI-inch trunnion-sleeves.
1 XV-inch bristle sponge.
3 XV-inch woolen sponge-covers.
1 XV-inch ladle.
1 XV-inch scraper for bore.
1 XV-inch scraper for chamber.
1 XV-inch sectional rammer.
32 IX-inch breechings.
19 IX-inch tackles.
21 IX-inch woolen sponges.
64 IX-inch woolen sponge-covers.
877 IX-inch shell-boxes.
5 IX-inch gun-scrapers.
13 IX-inch passing-boxes.
16 IX-inch locks.
2 IX-inch ladles.
1 IX-inch elevating-screw.
45 IX-inch tompions, wads, and laniards.
50 IX-inch carriage axle-washers.
12 8-inch woolen sponge-covers.
3 100-pounder woolen sponges.
3 100-pounder rammers.
3 100-pounder passing-boxes.

7 60-pounder iron carriages.
10 60-pounder iron directing-bars.
1 60-pounder wood carriage.
1 60-pounder breeching-shackle.
1 60-pounder breeching-shackle plate.
12 60-pounder pivot-bolts.
5 60-pounder breechings.
2 60-pounder gun-gripes.
2 60-pounder tompions and wads.
14 60-pounder gun-tackles.
6 60-pounder bristle sponges.
2 60-pounder woolen sponges.
18 60-pounder woolen sponge-covers.
21 60-pounder sponge-caps, canvas.
6 60-pounder muzzle-bags.
2 60-pounder sights.
2 60-pounder vent impression takers.
2 60-pounder locks.
2 60-pounder scrapers.
200 60-pounder shell-boxes.
6 60-pounder trucks.
13 60-pounder train-ropes.
4 20-pounder B. L. R.
6 20-pounder B. L. R. carriages.
11 20-pounder B. L. R. carriage directing-bars.
20 20-pounder B. L. R. tackles.
4 20-pounder B. L. R. breechings.
10 20-pounder B. L. R. breech-sights.
13 20-pounder B. L. R. elevating-screws.
20 20-pounder B. L. R. elevating-screw pins.
27 20-pounder B. L. R. collar guide-bolts.
14 20-pounder B. L. R. collar-latches.
43 20-pounder B. L. R. wrenches.
2 20-pounder B. L. R. thumb-latches.
5 20-pounder B. L. R. trunnion-sights.
22 20-pounder B. L. R. Broadwell rings.
11 20-pounder B. L. R. Broadwell ring-extractors.
14 20-pounder B. L. R. metal blocks.
180 20-pounder B. L. R. sabots.
20 20-pounder B. L. R. pivot-bolts.
6 20-pounder B. L. R. bristle sponges.
25 20-pounder B. L. R. woolen sponges.
10 20-pounder B. L. R. woolen sponge-covers.
3 20-pounder B. L. R. muzzle-bags.
292 20-pounder B. L. R. shell.
21 20-pounder B. L. R. shell-boxes.
1 20-pounder B. L. R. rammer.
14 20-pounder B. L. R. "dummy" shot.
9,650 cannon-primers.
5,492 cannon-primers, friction-quill.
91 laniards, with runners.
65 fuse-pickers.
31 fire-buckets.
143 fire-bucket laniards.
304 port-laniards.
42 port-bridles.
13 shell-whips.
4 powder-flasks.
50 thumb-stalls.
29 handspikes, roller.
20 handspikes, ordinary.
26 primer-boxes.
4 division-tubs.
4 fire-tubs.
132 heavers.
2 fuse-wrenches, No. 1.

HOWITZER, EQUIPMENTS, ETC,

1 3-inch B. L. R., bronze.
5 3-inch B. L. R., steel.

4 3-inch B. L. R. field-carriages.
22 3-inch B. L. R. field-carriage wheels.
24 3-inch B. L. R. catch-springs and washer.
12 3-inch B. L. R. hand-gripe screws.
509 3-inch B. L. R. shells.
59 3-inch B. L. R. shrapnel.
628 3-inch B. L. R. shell-sabots.
20 3-inch B. L. R. shell-boxes.
8 3-inch B. L. R. rim-base sights.
28 3-inch B. L. R. breech-sights.
210 3-inch B. L. R. charges.
12 3-inch B. L. R. "dummy" shot and carriages.
14 sets 3-inch B. L. R. cartridge-bag patterns.
6 3-inch B. L. R. caisson-boxes.
6 3-inch B. L. R. rammers and sponges.
286 3-inch B. L. R. shell-plugs.
3 3-inch B. L. R. tompions and wads.
7 3-inch B. L. R. haversacks.
3 3-inch B. L. R. sponge-caps.
6 3-inch B. L. R. drag-ropes.
400 3-inch B. L. R. cartridge-bags.
20 3-inch B. L. R. Broadwell rings.
7 3-inch B. L. R. Broadwell ring-extractors.
6 3-inch B. L. R. collar-latches.
6 3-inch B. L. R. thumb-latches.
14 3-inch B. L. R. elevating-screw pins.
12 3-inch B. L. R. wrenches.
12 sets 3-inch B. L. R. caisson-box fittings.
6 3-inch B. L. R. sponge-buckets.
10 boxes fuse cutters and clamps.
3 12-pounder boat-carriages.
2 12-pounder field-carriages.
8 12-pounder caisson-boxes.
37 12-pounder ammunition-boxes.
48 12-pounder passing-boxes.
7 sets 12-pounder boat-equipments.
4 12-pounder tompions and wads.
4 12-pounder ladles and worms.
12 12-pounder rammers and sponges.
25 12-pounder sponge-covers.
4 12-pounder sponge-caps.
4 12-pounder spare-article boxes.
1 12-pounder box for boat-irons.
4 wheel-chocks.
23 wheel-shoes.
12 12-pounder drag-ropes.
600 12-pounder cartridge-bag springs.
1,204 12-pounder cartridge-bags.
10 12-pounder boat-clamps.
1 set 12-pounder iron-work for boats.

SMALL-ARMS.

32 arm-chests.
32 battle-axes.
12 boat-chests.
310 cutlass-frogs.
41 battle-ax frogs.
126 pistol-frogs.
43 revolver-frogs.
669 waist-belts
145 pistol-cartridge boxes.
30 revolver-cartridges boxes.
172 rifle-cartridge boxes.
41 pike-guards.
72 single-sticks.
7 target-plates.
18 armorer's tools.
7 armorer's tool-chests.

MAGAZINE STORES.

300 saluting-charges.
5 powder-whips.
11 magazine-screens.
31 magazine-dresses.
162 60-pounder cartridge-bags.
350 32-pounder cartridge-bags.
112 12-pounder cartridge-bags.
1,120 20-pounder cartridge-bags, B. L. R.
200 20-pounder cartridge-bags.
400 8-inch M. L. R. cartridge-bags.
7 cans, copper-bound.
1 bucket, copper-bound.
1 60-pounder cartridge-bag former.
4 8-inch M. L. R. rifle cartridge-bag formers.
13 20-pounder cartridge-bag formers.
50 35-pound charges.
50 20-pound charges
20 prs. magazine-shoes.
7 magazine-lanterns.
24 magazine-candlestick springs.
1,081 adapting-rings.
1 shell-filling block.
1 powder-flag.
524 fuse-plugs.
462 Boxer fuses.
2,165 Bormann fuses.
441 Boxer fuse-igniters.
358 Boxer fuse-stocks.
1,148 Bormann fuse-stocks.
1,500 5-inch fuses for 8-inch M. L. R., N. M. S.
3,330 5-inch fuses for spherical shell, N. M. S.

TORPEDOES.

10 sets torpedoes, complete.
18 bridle-wires.
750 feet ash scotchman.
10 torpedo-tackles.
20 torpedo-guys.
6 sets torpedo-gear.
2 copper rings for D. E. machine.
6 torpedo-cases, tin.
6 torpedo-floats, tin.

Experimental work of all kinds, viz: Explosives; gun-cotton; dynamite; picric acid; nitro-glycerine; distilling acid; McLean's steering-gear; Converse's steering-gear; circuit-closers; wire terminals and connections; Howell torpedo; Lay torpedo; Ericsson torpedo; fish-torpedo; experimental torpedo; telephone; dynamometer; galvanometer; Newell's testing and firing plate; battery for inside contact torpedo; electric speed-indicator; electric-battery cells; electric-primer connections; electric lamps; Davis torpedo-socket.

Repairs to deteriorated stores on hand.
Repairs to tools, &c.
Repairs to buildings and wharves.

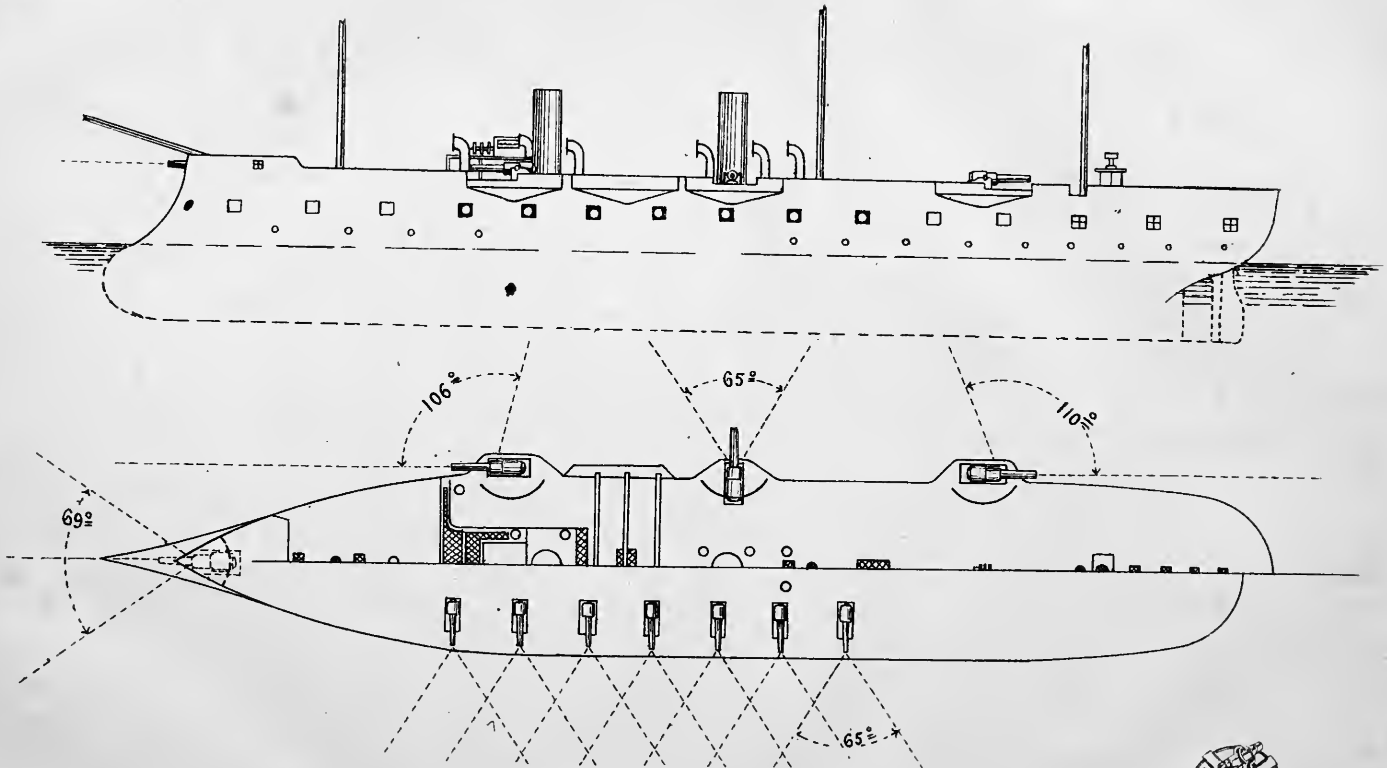
MISCELLANEOUS.

22 60-pounder pivot-sockets.
4 set 60-pounder-carriage castings.
6 60-pounder friction-chocks.
16 60-pounder breeching-thimbles.
8 60-pounder clevis-bolts.
4 20-pounder deck-sockets.
20 20-pounder breeching-thimbles.
1,893 deck-circle screws.
4 sets deck-circles.
76 arm-chest hinges.
12 arm-chest hasps.

30 arm-chest staples.
53 handspike-shoes.
4 training-eyebolts.
12 powder-scuttle funnels.
20 shrapnel bouchings.
2 pressure-gauges.
1 pressure-gauge box.
1 pressure-gauge wrench.
253 pressure-gauge disks.
1 60-pounder templet.
2,445 pounds bloom-iron.
16 shot-plugs.
42 grate-bars.
362 tallies.
1 hatch-cover.
1 wooden powder-boat, repaired.
24 pairs can-hooks.
2 gun-slings.
1 stationary packing-box.
39 rough packing-boxes.
6 fuse-taps.
2 fuse-plates.
2 fuse-tap wrenches.
1 drill.
2 recoil-indicators.
13 target-frames.
1 pendulum.
32 shell-stand braces.
56 copper bolts.
12 loop-studs for friction-primer.
1 loop-stud for die-plate.
709 hooks for gun implements.
100 hooks for rammers and sponges.
4 hooks for transporting-trucks.
285 hooks for fire-buckets.
157 hooks for lanterns.
130 hooks for powder-chutes.
15 hooks for handspikes.
2 brackets for target-plate.
94 sets brackets for pistols.
100 sets brackets for rifles.
42 buttons for pistol-frogs.
100 tub-cleats.
Repairs to stores on hand.
Repairs to tools.
Repairs to buildings, wharves, shot-beds, gun-skids, &c.

List of vessels for which work has been performed for the year ending June 30, 1878.

Alaska.	Huron.	Monocacy.	Saratoga.
Alarm.	Hartford.	Monongahela.	Saugus.
Ajax.	Jason.	New Hampshire.	Shenandoah.
Ashuelot.	Juniata.	Omaha.	Supply.
Congress.	Kansas.	Ossipee.	Swatara.
Constitution.	Kearsarge.	Portsmouth.	Ticonderoga.
Colorado.	Lancaster.	Passaic.	Tuscarora.
Constellation.	Lehigh.	Pensacola.	Wabash.
Canandaigua.	Lackawanna.	Plymouth.	Wachusett.
Dictator.	Mahopac.	Powhatan.	Wyandotte.
Enterprise.	Manhattan.	Quinnebaug.	Wyoming.
Frolic.	Michigan.	Richmond.	Yantic.
Guard.	Minnesota.		



DUQUESNE. — TOURVILLE.

TYPES OF UNARMORED SHIPS IN THE FRENCH FLEET, AS SHOWN BY MODELS AT THE EXPOSITION AND IN THE LOUVRE.

PARIS, FRANCE, *November* 1, 1878.

SIR: Having reviewed the peculiarities and condition of the French iron-clad fleet as represented by models at the Louvre and Exposition, a report would scarcely be complete that failed to detail at least as thoroughly the types and strength of the unarmored fleet.

In the types of unarmored ships, as in their iron-clads, I find the same wide departure from English styles of construction.

The French having shown their partiality for barbette turrets in the iron-clads, carry the same principle out in their newest types of fast cruisers. Where the English aim at a moderate bow-fire, the French strive for the greatest possible; and where the English sacrifice stern-fire almost completely, the French secure moderate power in stern-chasers, with a tendency to even make it equal to bow-fire. Where the English have provided for the discharge of Whitehead torpedoes, the French apparently use exclusively a towing torpedo. The straight or the old-fashioned bows of the English are hardly ever found with the French, where the long ram-bow is the rule.

Finally, the sailing qualities of French ships are never sacrificed, except it be in the one condition that in no type do they hoist their propellers.

According to the programme of the fleet decided upon in 1872, the unarmored ships of the French navy were classed as follows:

8 fast frigates (first-class cruisers).
8 fast corvettes (second-class cruisers).
18 first-class avisos.
18 second-class avisos.
10 transport avisos.
32 gunboats.

The models of most of the types were at the Exposition, and I found others at the Louvre, which I believe make the list entire, with the exception of two types: the first-class cruiser, type Venus, and the launch-gunboat, type Epee. If there are any others, they belong to Crimean war types, and are probably near the end of their service.

In examining the models, I have carefully studied French views, as expressed in the writings of Baron Grivel, Admiral Paris, M. Dislere, M. Marchal, and the official marine publications. Unfortunately, I could not study at the same time English models, which, had I been able to do, would no doubt have made a more correct judgment possible. The only English models at the Exposition were the Opal, Medina, and gunboats built for foreign navies—Constitucion, Republica, Parana, and Uruguay.

I have at the close of the report included as a French type the Spanish gunboat Jorge Juan, built by the Compagnie des Forges et Chantiers de la Mediterranée.

In making drawings, I had the same difficulty to contend with as before, in not being allowed to sketch on the spot.

The general form is, however, as correct in all cases as my slight skill in drawing and lack of facilities would permit.

FIRST-CLASS CRUISER.

Type: Duquesne, Tourville.

Length between perpendiculars	327 feet.
Outside beam at water	50 feet.
Mean load-draught	22 feet 7 inches.

Displacement	5,340 tons.
Area of immersed midship section	796.5 square feet.
Power developed by engine	7,340 horse-power.
Maximum speed	16.93 knots.
Coal-supply	648 tons.
Distance attainable at 10 knots	4,300 miles.
Sail-surface	20,444 square feet.
Proportion of sail surface to midship section	25 to 1
Number of crew	450 men.
Spar-deck battery, 7½-inch caliber	7
Gun-deck battery, 5½-inch caliber	14
Fire directly ahead:	
Number of guns	3
Weight of metal thrown	412.5 pounds shell.
Effective range against unarmored ships	8,000 yards.
Fire abeam:	
Number of guns	10
Weight of metal thrown	818.5 pounds shell.
Power of penetration, at 1,000 yards, for 3 battering shell	9 inches.
Fire astern:	
Number of guns	2
Weight of metal thrown	330 pounds shell.
Power of penetration at 1,000 yards	9 inches.
Height of battery above water-line: Spar-deck	23 feet.
Height of battery above water-line: Gun-deck	13.5 feet.

Two ships of this type, Duquesne and Tourville, are now afloat, and as yet, I believe, no steps have been taken to lay down another, although, as far as I can learn, there have been no adverse opinions expressed with regard to them by French naval officers. In comparing them with English ships of their class, they take a place between the Shah and Raleigh—length and beam approaching the former, while the displacement is only 200 tons greater than the latter. The speed of the Duquesne, at her official trial, is reported as 16.93 knots, and that of the Tourville as 17; while the Shah is rated at 16.45, and the Raleigh at 15.32. Thus, apparently, the French have attained a better design of hull, gaining for a ship of proportionally the same size a lighter displacement and draught and a greater speed, while they have not been obliged to resort to cement filling to gain stability.

The battery for this type of ship was first fixed at seven guns of 16 centimeters for the spar-deck, and 20 guns of 14 centimeters for the gun-deck; but the one actually placed aboard is seven of 19 centimeters, and fourteen of 14 centimeters. This latter seems more in accordance with the strictly military and excellent rule laid down for the armament of this type, viz, that there should be two distinct kinds of battery, one made up of artillery of position, or heavy artillery, and the other of light. The spar-deck battery, contrary to the old rule of armament, has the heavy guns; for the reason that there, *en barbette*, they can sweep the horizon within an angle of fire of 180°, and also gain the maximum of elevation and depression. Their great firing-angle makes transportation unnecessary; weight, therefore, in so far as mobility is concerned, is of little consideration. A good angle of depression being considered an absolute necessity, in close action especially, these guns which possess the greatest penetrating power are raised to the greatest height possible compatible with stability. Herein lies the *raison d'être* of the half-turret. The gun being of the heaviest caliber is given all the freedom of action possible. Center pivoting, in order not to derange the movable weights of the ship more than possible, nor to unnecessarily increase the projecting turret, takes up the least possible space. Finally, while its bow and stern control make raking fire dangerous for the enemy, the gun itself is well protected from

dismounting by raking, both by its position (fore and aft) to receive fire and the rails in front of it. The gun-deck fire is perforce limited to small horizontal angles and angles of depression; here the light battery is placed, and, being of a weight easily transported, the broadside can at will be re-enforced by guns from the other side of the deck.

By the reduction of the gun-deck battery from twenty to fourteen pieces, a heavier stationary battery was made possible, while the broadside, being seven guns on the gun-deck, can in action be increased to ten, the old number, without detriment to the fighting capabilities of the ship.

In choosing the calibers for the battery, the exigencies of the service required of the ship were fully taken into consideration. While with the English ships it was attempted to realize a cruizer that might stand up against a foreign iron-clad, the French limited the work of the ship to fighting the best of its own kind. The 19-centimeter gun furnished a caliber thoroughly efficient for all fighting ranges, and probably as good as a large caliber at short range against unarmored vessels. For the work required of it, it was better than the 16-centimeter, and as good as the 21-centimeter when mobility is taken into consideration.

The gun-deck battery, limited in firing as it is, can only come into full service in close action, and for this 14-centimeter possessed sufficient power with mobility and a weight such as to allow a maximum number of guns to a broadside.

In comparing the offensive power of the Tourville with that of the Shah and Raleigh, it is found that the strength of battery of both the latter ships exceeds that of the Tourville both in number of guns and weight of metal. The English ships have for bow-fire one 23-centimeter gun, the Tourville three 19-centimeter. The extreme range of the 19-centimeter gun is 9,000 meters, and it is considered that 7,000 meters may safely be taken as the extreme of firing-range at sea. At this distance there can certainly be but slight chance of hitting the small target presented by a flying enemy, and the 19-centimeter can certainly be depended upon at that distance to work effectively against iron merchantmen or unarmored men-of-war as well as the heavier caliber.

For circumstances requiring bow-fire, either in chase or attack, the Tourville must be granted superiority due to number of guns. Her chances of hitting a flying enemy are more than three times as great (allowance being made for rapidity of handling the guns and increased freedom of movement). In an attack, up to close range her raking-fire is more powerful, and in a rapid close, where there is but little time to do harm, the chances of disabling an enemy by chance shots are greatly increased. The same reasoning applies to stern-fire in a slightly modified degree. Apparently at least one 14-centimeter gun can be transported to the stern ports, making stern and bow fire nearly equal. The requirements of stern-fire are so varied, that it seems to me criminal to neglect it. The ship must run from a cruising iron-clad, and having speed in her favor, although her guns are light, they are better for curved fire, which would be more effective, than heavier calibers. The fighting must be at long range and the hits would be chance ones, thus increasing the value of number of pieces. In close action, in fleet-fighting, the stern must be presented to the enemy at some time, and here the value of a gun ready loaded at the proper instant may become incalculable. Finally, allowance must be made for disabling machinery. In this case, for the safety of the ship, there must be not only no dead angle, but there must be a strong fire all around.

For beam-fire the English ships are much superior in weight of metal,

the number of guns being about the same (Shah, 14; Tourville, 13; Raleigh, 12), allowing the Tourville to transport three of her 14-centimeter guns to the fighting broadside, which could not be done with heavier calibers. So much can be said on either side with regard to the value of the fire that comparison seems impossible. On the one side it may be argued that against unarmored ships the Tourville calibers are heavy enough at all reasonable fighting ranges, leaving a margin of superiority for rapidity of fire for the lighter guns. In attacks on fortifications or fleet-fighting with iron-clads, however, the heavier battery is the more valuable. Apparently the 14-centimeter gun is the heaviest caliber that can, all things taken into consideration, be readily transported. Many French officers would prefer a 16-centimeter to a 14-centimeter gun-deck battery. This, however, would reduce the present possible broadside of 10 guns to one of 3, since the 16-centimeter would not admit of transportation, and the weight, gun for gun, is more than double for the 16-centimeter that of the 14-centimeter of the 1864 model. It has occurred to me that since the broadside firing is confined to fighting, perhaps a slight change in the spar-deck battery would improve both the navigational power and the effective strength for fighting, without reducing strength elsewhere. That is, in place of the 19-centimeter guns in the center half-turrets, to substitute a center-pivoting 24-centimeter gun amidships between the smoke-stacks. This would give a good armor-piercing caliber. The dead weight would be about the same, but in a better position, and the gun would have the slight raking protection of the foremast and forward smoke-stack. There would be a loss, however, of horizontal firing angle and absolutely no depression, while the deck in the wake of the gun would probably have to be plated or otherwise protected against damage from discharge. The latter point, however, does not appear to be of much importance, since it is successfully worked out in the Duguesclin and Duperré. These being the very last types of iron-clads, whatever objection is offered to the change must apply to these vessels, where certainly they have not nullified the advantages. Apparently, there is room for the change without moving the smoke-stack. The only real disadvantage appears to me to be the addition of a third caliber. In this respect it is well to mention that the French again differ widely from the English in unqualifiedly condemning the system of making a man-of-war a "museum of artillery."

Another point in favor of the Tourville's battery is that, although she has a more powerful fore and aft fire, the ends of the ship are relieved immensely from the great strain and bad balancing effect of the heavy 23-centimeter guns of the Raleigh.

Thus it seems to me, after examination, that, for the services that such ships are called upon to perform, the Tourville is the superior in spite of the difference of weight of metal. As a cruising flag-ship in time of peace, she is, I think, without doubt better in every respect than an iron-clad of the Alma type, although in accordance with French policy the iron-clads must be represented in foreign fleets as visible evidence of naval strength. The Tourville's sail-area is ample; her coal-supply as good as the best; her draught very light for her general qualities and size; her battery is heavy enough to answer in almost any sudden emergency, and her quarters are in every way comfortable. In war-time, her powerful bow-fire would never fail to bring down her prizes at long range, her sweep of heavy spar-deck fire considers almost every circumstance of position in attack or defense, and, to my mind, with the change suggested above, she would be a match for either the Shah or Raleigh in a duel, while her effectiveness against fortifications, or blockade service,

or in fleet-fighting with iron-clads, would be the greatest that can be expected of an unarmored ship.

The lines of this type are very fine forward, the timbers for the length of the forecastle being given a flare from the spar-deck level up, sufficient to give plenty of working room for the bow-gun. They have a full, powerful shoulder and very slight sheer. The cat and fish davits in this, as in all late types, are pivoted so that they may be swung fore and aft, leaving a clear side. The service-wheel also, as in all French men-of-war, is forward of the smoke-stacks on the bridge. This is a point which I think may well be considered by our own constructors. Why, in a man-of-mar, the service-wheel should be low down and away aft, has always been a puzzle to me, only to be answered by the reason that it is the custom, and perhaps by the old notion that the helmsman must have the main topsail to steer by. Our bridges are found anywhere between the smoke-stack and poop; never where the watch-officer can keep a clear lookout ahead and have the helmsman and binnacle under his eye. I have served in three of our ships where, the bridge being between the smoke-stack and mainmast, the watch-officer could not see the sails on the main, nor keep a clear lookout forward; standard and binnacle compasses might almost as well have been in the cabin for all the use they were to him, and the helmsman was almost out of sight and sound. He, however, had the benefit of the warmth (and cinders) from the fire-room in cold weather. The Duquesne has a bridge pilot-house, a feature also found in most French types, and a chart-room abaft the smoke-stack. Between the two forward half-turrets, and projecting slightly clear of the side, are large wash-rooms and round-houses. Resting on these are, athwart ship, boat-cradles which hold the waist and quarter-deck boats at sea, leaving a clear, high passage underneath and opening the fore-and-aft line of fire. The mainsail can be carried close hauled without interfering with the smoke-stack. The spar-deck is flush from the break of the forecastle with very clear gangways. The ships have steel frames and iron hulls sheathed with planks and coppered. The engines are of the compound horizontal pattern, with six cylinders. Boilers of the high regulation type, of medium pressure, twelve in number, with forty-eight furnaces. A great space is devoted to the engine-room in order to secure the advantageous system of placing one engine abaft the other in order that both may not risk being disabled by a single shot, as might be the case were they abreast, in spite of the weak bulkhead between them, as in the Shah. In this manner good working space is secured and accessibility to all the working parts. In none of the French types does the screw hoist. The dead-eyes of the lower rigging set up inside the rails.

FIRST-CLASS CRUISER.

Type: Venus.

Although I can find no model or description of this type, I insert the slight description possible from having been in company with and aboard of two of these ships in 1868, in Japan.

This type belongs to what is now called the old fleet, and is similar in disposition of battery to the gun-deck corvettes of the past decade. If I remember right, they carried neither bow nor stern pivots, but on the spar-deck had four light broadside guns, about 14 centimeters, or possibly 12 centimeters. The main-deck battery was, I believe, eighteen 14-centimeter guns. The battery at present is put down as sixteen guns, which, if only caliber is changed, would, I suppose, admit four of 14 centimeters on the spar-deck and twelve 16 centimeters on the gun-deck.

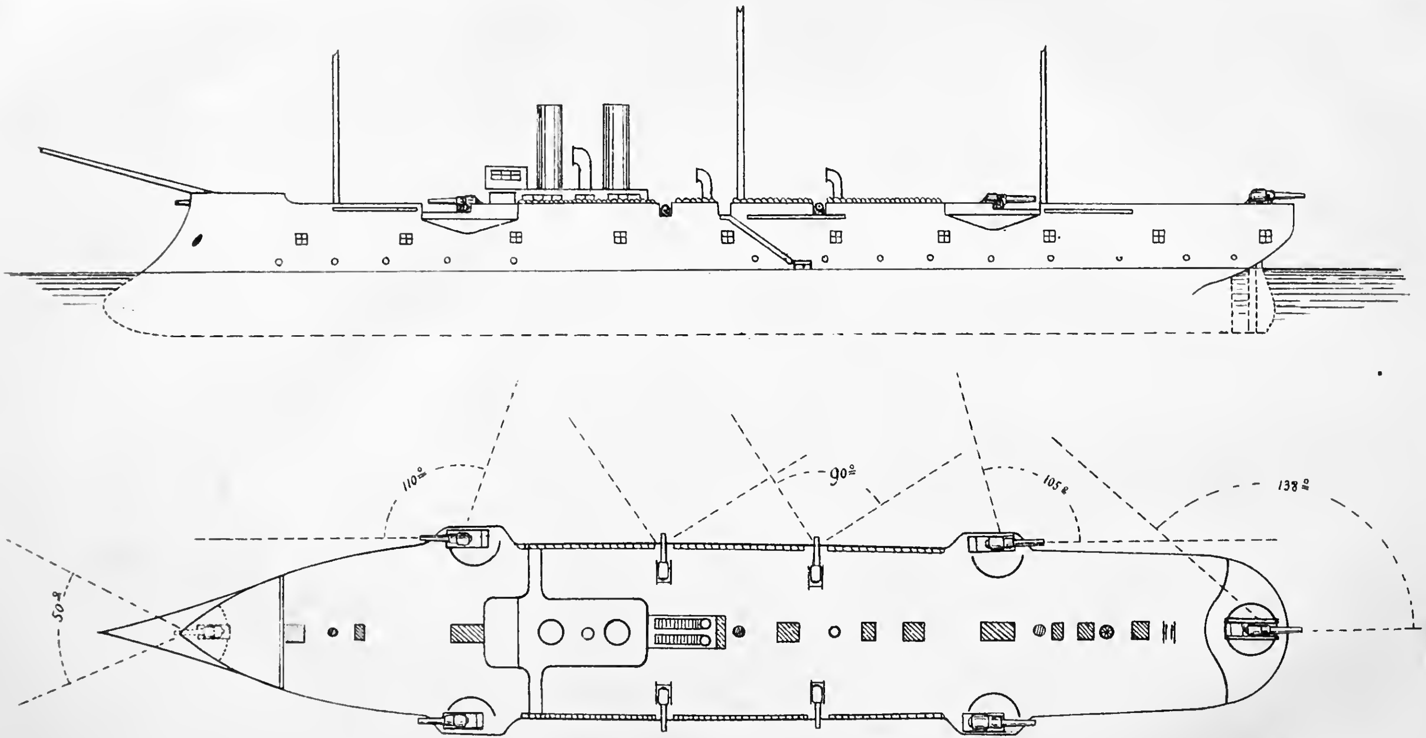
The speed is rated at fourteen knots. The ships of this type that I have seen are the Venus and Minerve. Both of them are in commission at present as flag-ships. Whether there are any more of the type or not, I do not know; although in the official category there are eight first-class cruisers noted (names not given) besides the Duquesne and Tourville. Some of these may be old frigates of the Minnesota type, with reduced batteries of 14-centimeter guns.

SECOND-CLASS CRUISER.

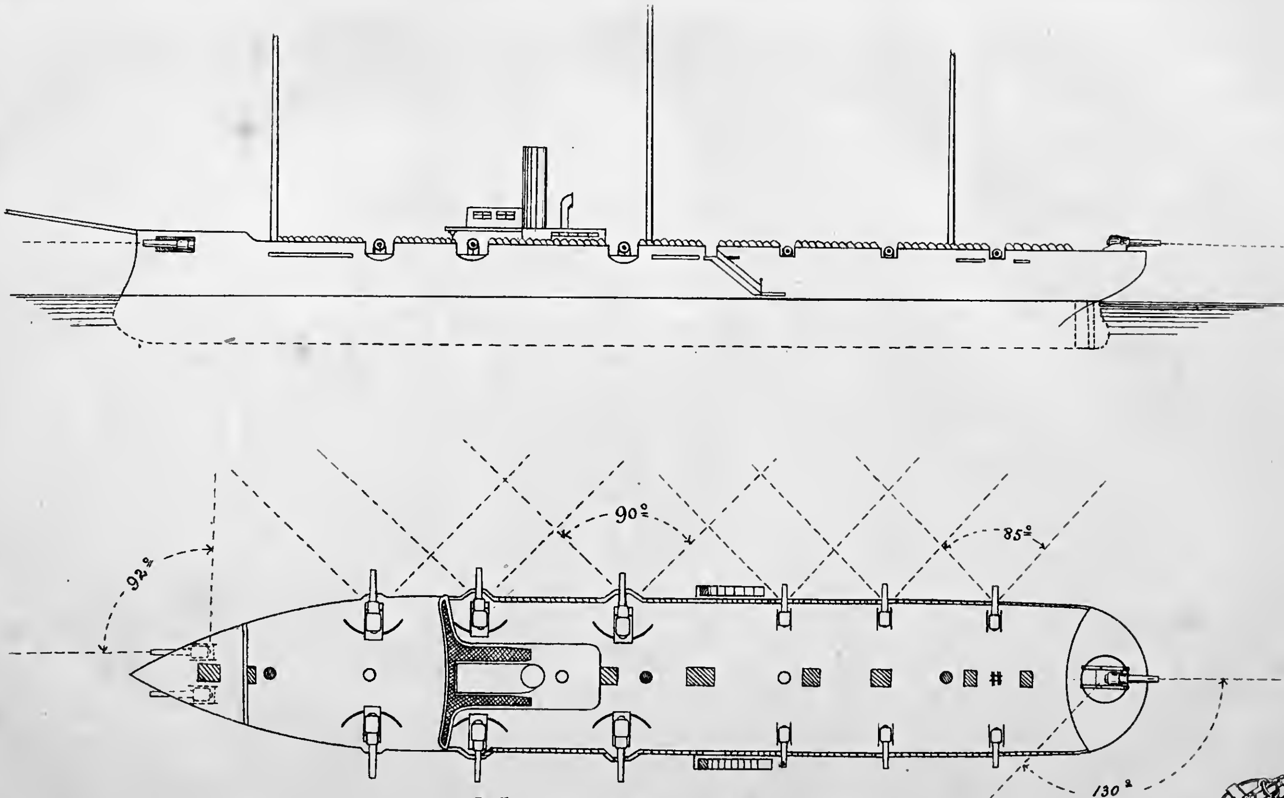
Type: Duguay-Trouin.

Length between perpendiculars	290 feet.
Outside beam at water-line	42.8 feet.
Mean load draught	16.9 feet.
Displacement	2,990 tons.
Area of immersed midship section	576.9 square feet.
Power developed by engine	3,740 horse-power.
Maximum speed	16 knots.
Coal-supply	430 tons.
Distance attainable at 10 knots	4,000 miles.
Sail-surface	19,134 square feet.
Proportion of sail-surface to midship section	25 to 1.
Number of crew	230 men.
Battery:	
7½-inch caliber	5
4½-inch caliber	5
Fire directly ahead:	
Number of guns	3.
Weight of metal thrown	376.5 pounds shell.
Effective range against unarmored ships	8,500 yards.
Fire abeam:	
Number of guns	5.
Weight of metal thrown	469.5 pounds shell.
Fire astern:	
Number of guns	3.
Weight of metal thrown	376.5 pounds shell.
Height of battery above water-line	14 feet.

This type corresponds nearly to the English Rover, and is fully as remarkable as the Tourville for originality of disposition of battery. Her guns are all on the spar-deck, although, judging from the appearance of the model, she has a clear gun-deck, or, as it should properly be called in this case, "between decks." The length and beam correspond closely to the Rover, although the draught and displacement are much less. The speed of the Rover is given as 14.5 knots, while the Duguay-Trouin has 16. The difference in battery power is about the same as between the Shah and Tourville, although in this case the heavier broadside is in favor of the Trouin, while the better disposition renders her generally more effective. For bow-fire the Trouin has three guns of 19-centimeters to one of 18-centimeters of the Rover. This strength of bow-fire is claimed, but, after examination of the model, seems hardly fair to be allowed, since the lower rigging, coming to channel-ways outside the rail, cuts off about 5° from the turret-guns. Even with this, however, the Trouin has the heavier bow-gun for single fire. For stern-fire she has two 19-centimeters and one 14-centimeter clear fire against one 18-centimeters of the Rover. In broadside, two 19-centimeters and three 14-centimeters against two 18-centimeters (?) and eight 16-centimeters. This gives the Rover an undoubted superiority, since, as between unarmored ships, the difference of working effect between 19-centimeters and 18-centimeters is scarcely worthy of account, both being far superior to the resisting



DUGUAY TROUIN.



MAGON. — ROLAND.
FORFAIT. - VILLARS.

power of the target, and the Rover has both number and caliber of lighter pieces in her favor.

I have imagined a different disposition of battery for the Trouin, which would seem to strengthen the broadside without materially lessening the strength of fore-and-aft-fire. By substituting 16-centimeter for the 19-centimeter guns, the bow-gun could be placed on the forecastle, which would cut off the direct forward fire, but the turrets, I think, could be carried out to give two 16-centimeter guns direct fire clear of the fore-rigging without changing the rolling leverage. Putting two 16-centimeter guns in the after turret would certainly allow an additional pair of broadside 14-centimeters abaft the mizzen-mast. In this way there is a loss of working effect, possibly serious in a ship of this size, and which much reduces her value in coast fortification attack or blockade work, but I think an increase of broadside power for fighting purposes, certainly an increase for chasing.

In a ship of this size, however, the settlement of battery power is a difficult matter, to me at least, since I am of the opinion that with a displacement of 500 tons greater, or with ships of the English Bacchante type, the strength of battery may be more nearly brought to the size of the ship without loss to other qualities.

Chief Engineer King, in his report on European ships of war, mentions this class of ship as being one much needed in our service. In this I am inclined to differ with him, in that, for our first-class cruisers, ships of the Trenton's displacement and measurement would give a greater proportional battery power, while for the working fleet of unarmored ships, a type of ship to be mentioned further on would form the best support.

The most noticeable feature of the Duguay-Trouin is the attempt to carry out the idea of an extreme command of gun power and a high platform.

The between-decks may give rise to criticism on the score of waste of space, but the additional height of battery is worth it. It is in this connection that I am inclined to favor enough greater tonnage to make a gun-deck available.

The Trenton, for example, given a gun-deck battery of breech-loading 100-pounders of the same number as the Rover's battery, could, I think, carry four 8-inch guns in half-turrets like the Trouin, giving her good bow and stern fire and a broadside heaver than the Rover's in spite of our greater weight of metal in converted guns. With new guns the broadside could be brought up at least to the Bacchante, with a superior fore-and-aft fire.

The boilers and engines of the Duguay-Trouin are of the same type as, and arranged similarly to, those of the Duqusene. She carries her mainsail on a wind without interference.

SECOND-CLASS CRUISER.

Type: Villars, Forfait, Magon, Roland.

Length between perpendiculars	249.3 feet.
Outside beam at water-line	38.0 feet.
Mean load-draught	15.9 feet.
Displacement	2,227 tons.
Area of immersed midship section	448.5 square feet.
Power developed by engine	2,500 horse-power.
Maximum speed	15.5 knots.
Coal-supply	400 tons.
Distance attainable at——knots	4,000 miles.
Sail surface	13,988 square feet.

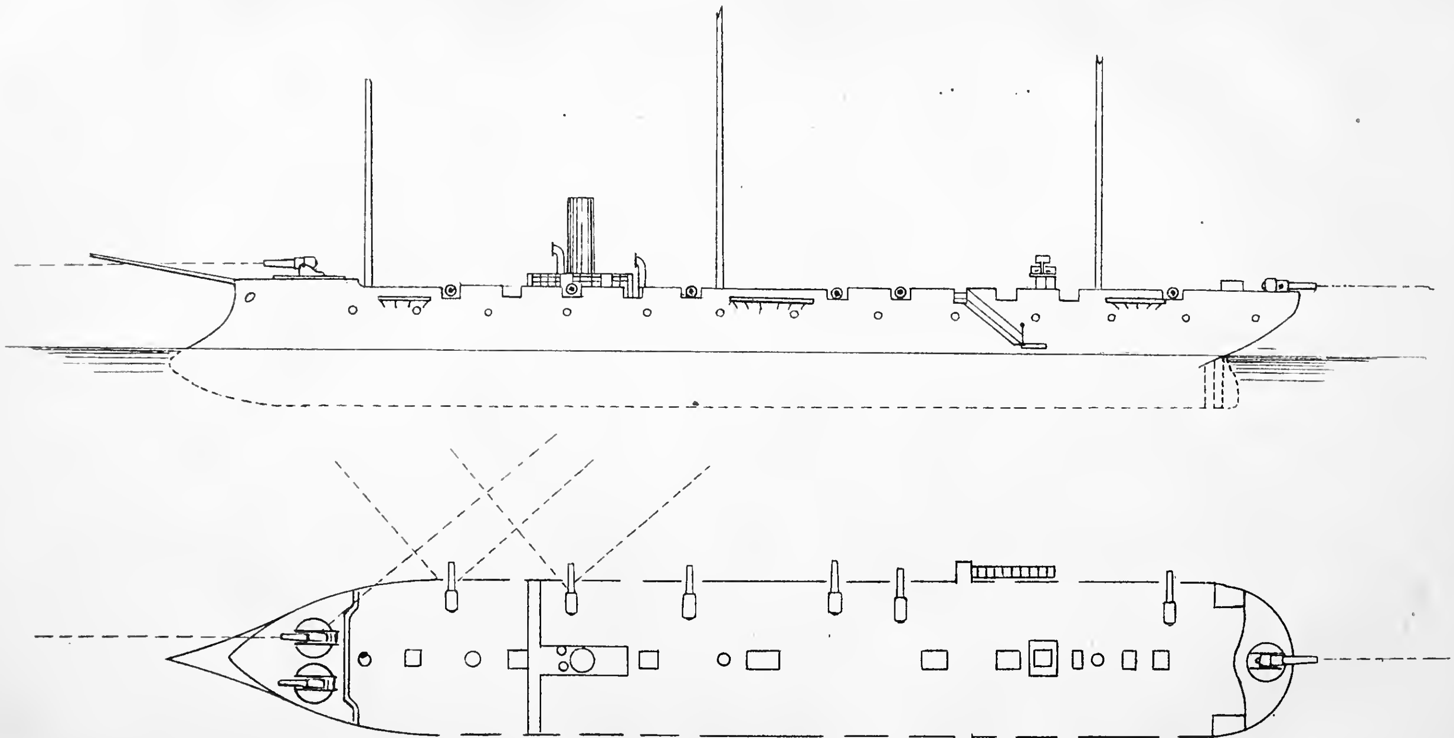
Proportion of sail surface to midship section	31 to 1.
Number of crew	220 men.
Battery:	
$6\frac{3}{10}$-inch caliber	6.
$5\frac{1}{2}$-inch caliber	9.
Fire directly ahead:	
Number of guns	2.
Weight of metal thrown	93 pounds shell.
Effective range against unarmored ships	5,500 yards.
Fire abeam:	
Number of guns	8.
Weight of metal thrown	532.5 pounds shell.
Fire astern:	
Number of guns	2.
Weight of metal thrown	46.5 pounds shell.
Height of battery above water-line	

This type of cruiser is in size between the Opal and Rover, being nearer the dimensions of the former. Like the Opal she has a recessed bow for two bow-guns, although her forecastle is carried out above and below so as to form a recessed port. The Opal's stern is recessed in the same way, as she has a poop cabin, while the flush deck of the Villars allows a single barbette-gun. The bow-fire of the two ships is the same if for chasing the 14-centimeters be given the value of 16-centimeters; the stern-fire is in favor of the Opal, which has two 16-centimeters against one 14-centimeter of the Villars. In broadside the Opal has seven 16-centimeters against three 16-centimeters and five 14-centimeter guns. To the Opal, then, must be given superiority all around, although having 300 tons less displacement. Other advantages appear in the Opal, such as a large topgallant forecastle, giving better berthing facilities forward, and a poop cabin, giving better berthing aft. The weak point of the English vessel is her speed of only 13 knots, against 15.5 of the Villars. This in a small ship, or one of this kind, intended especially for convoy and blockade service, is a vital fault. It will perhaps be well to notice here, that in all the smaller classes of French vessels, the galley is placed either just forward or abaft the smoke-stack, and apparently without detriment to draught in the fire-rooms, another point for the consideration of our constructors. One of the greatest evils to be contended with in our own service is the position of the galley in the small ships, which either makes the berth-deck uninhabitable, or under the topgallant forecastle is either in the way of chains and hammocks, or is in constant danger of being washed out. In comparing this ship with the Duguay-Trouin, it will, I think, be found that for convoy, blockade, or commerce-destroying work, the batteries are of about equal service, the advantage to the Trouin being only found in fleet fighting or fortification attack, while the expense of building and cost of maintenance in commission in a fleet during peace scarcely, I think, warrant their construction.

SECOND-CLASS CRUISER.

Type: Laperouse, D'Estaing, Monge, Nielly.

Length between perpendiculars	262.4 feet.
Outside beam at water-line	37.4 feet.
Mean load-draught	17 feet.
Displacement	2,200 tons.
Area of immersed midship section	433.7 square feet.
Power developed by engines	2,500 horse-power.
Maximum speed	15.5 knots.
Coal supply	400 tons.
Distance attainable at 10 knots	4,000 miles.



LAPEROUSE. – MONGE. – NIELLY. – D'ESTAING.

Sail surface	13,988 square feet.
Proportion of sail surface to midship section	31 to 1.
Number of crew	220 men.
Battery:	
$6\frac{3}{10}$-inch caliber	6.
$5\frac{1}{2}$-inch caliber	9.
Fire directly ahead:	
Number of guns	2.
Weight of metal thrown	93 pounds shell.
Effective range against unarmored ships	5,500 yards.
Fire abeam:	
Number of guns	8.
Weight of metal thrown	532.5 pounds shell.
Fire astern:	
Number of guns	1.
Weight of metal thrown	46.5 pounds shell.
Height of battery above water-line	

This type is the counterpart of the Villars, except that with a slightly less displacement she has finer lines, a ram-bow, and carries her bow-guns on the topgallant forecastle; an arrangement which has been decided upon for all future small ships. The bow-guns, it will be noticed, are center-pivots; this is now the rule of the French navy for all pivot-guns.

THIRD-CLASS CRUISER.

Type: Infernet.

This type was designed in 1867 and 1869, the following-named vessels being built and commissioned: Infernet, Champlain, Chateau Renaud, Dessaix, Dupetit-Thouars, Fabert, La Clocheterie, Sané, Saigneley, Derres, and Laplace. They form a distinct class worthy of study in connection with the improved type lately added. The dimensions are:

Length between perpendiculars	246 feet.
Outside beam at water-line	36 feet.
Mean load-draught	12.5 feet.
Displacement	1,370 tons.
Sail surface	15,204 square feet.
Coal supply	300 tons.
Maximum speed	14.43 knots.
Number of crew	210 men.

These vessels were at the time of construction rated second class. They are, as represented by the Infernet, flush fore and aft, with a stern similar above water to the bow. They carried a 16-centimeter gun forward, just abaft the heel of the bowsprit, the rail dropping on either side as far forward as the knight-heads to permit bow-fire to within, I should judge, 15° of right ahead, the gun being a center-pivot. There were eight 14-centimeter guns in broadside, the after pair giving fire right astern by dropping the after part of the rail. Their bow-fire therefore was nothing; broadside, five 14-centimeters, and stern, two 14-centimeters. After a full trial with the class it was found that the movable rail forward was a nuisance, as it was liable to be carried away whenever steaming head to sea. For strengthening the bow and protection of the crew a topgallant forecastle was decided as an absolute necessity. The ram-bow was decided upon not only as a weapon but as giving increased stability forward without being detrimental to power of maneuvering. From the results of the trials of this type sprang the

THIRD-CLASS CRUISER.

Type: Eclaireur, Rigault de Genouilly.

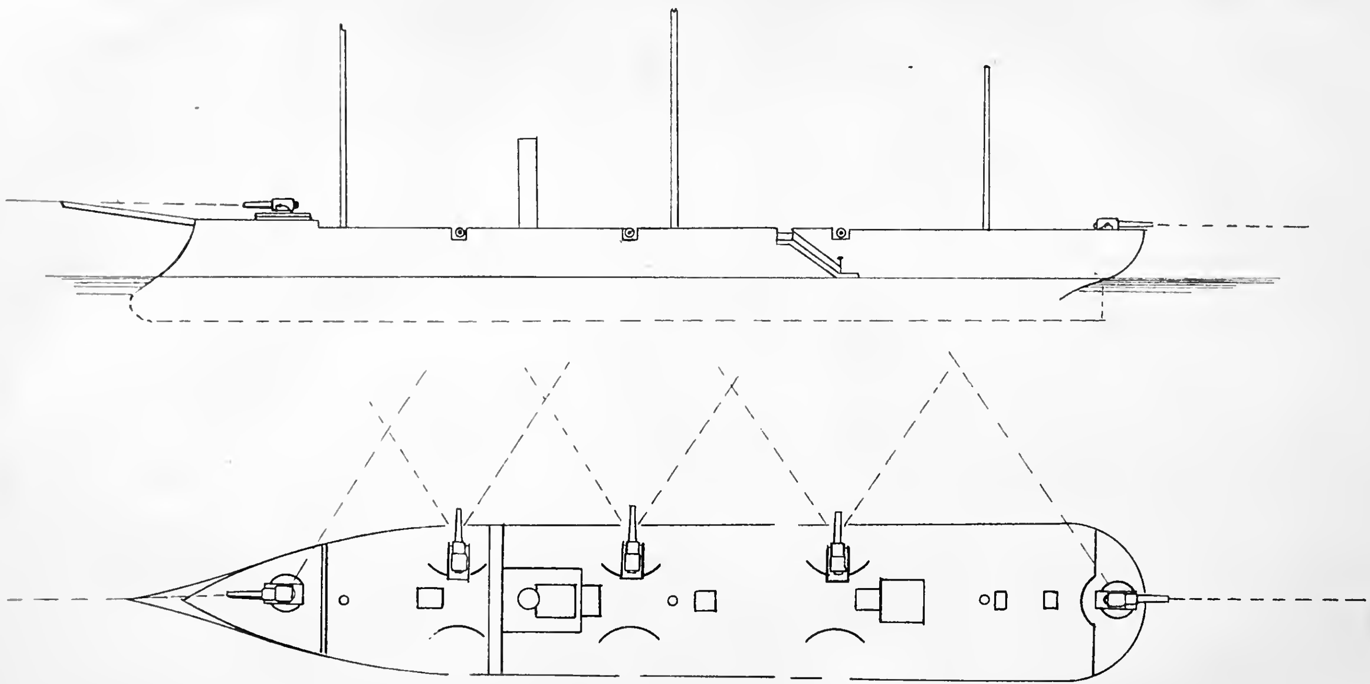
Length between perpendiculars	236 feet.
Outside beam at water-line	35.4 feet.
Mean load-draught	14.7 feet.
Displacement	1,610 tons.
Area of immersed midship section	365.8 square feet.
Power developed by engine	1,900 horse-power.
Maximum of speed	15 knots.
Coal supply	210 tons.
Distance attainable at 10 knots	3,000 miles.
Sail surface	13,450 square feet
Proportion of sail surface to midship section	36.5 to 1.
Number of crew	160 men.
Battery, 5½-inch caliber	8.
Fire directly ahead:	
Number of guns	1.
Weight of metal thrown	46.5-pound shell.
Effective range against unarmored ships	5,500 yards.
Fire abeam:	
Number of guns	5.
Weight of metal thrown	232.5-pound shell.
Fire astern:	
Number of guns	1.
Weight of metal thrown	46.5-pound shell.
Height of battery above water-line	11.4 feet.

This type belongs between the Amazon and Blanche in measurement. The bow-gun presents the peculiarity of being centered slightly to starboard so as to give clear forward fire. The Amazon and Blanche carry their batteries amidships, and not being center-pivots give the vessel a desired heel when firing in broadside. The Eclaireur has one 14-centimeter for bow and stern fire; the Blanche one 16-centimeter for each. The Eclaireur delivers five 14-centimeter shots at a broadside, the Blanche two 18-centimeter and two 16-centimeter. Thus the Blanche with a slightly greater displacement gives a much heavier fire, but only at a sacrifice of stability, very hurtful to small ships in a sea-way. The Eclaireur keeps her battery balanced, and has one more gun for broadside. The speed of the Blanche is 13 knots against 15 for the Eclaireur. This type, as well as the Laperouse and Villars, is composite built, having compound engines of the Woolf type. They are bark-rigged, with stump topgallant mast. The topgallant forecastle is very roomy, giving good berthing space, and the stern-gun follows the accepted rule of firing *en barbette.*

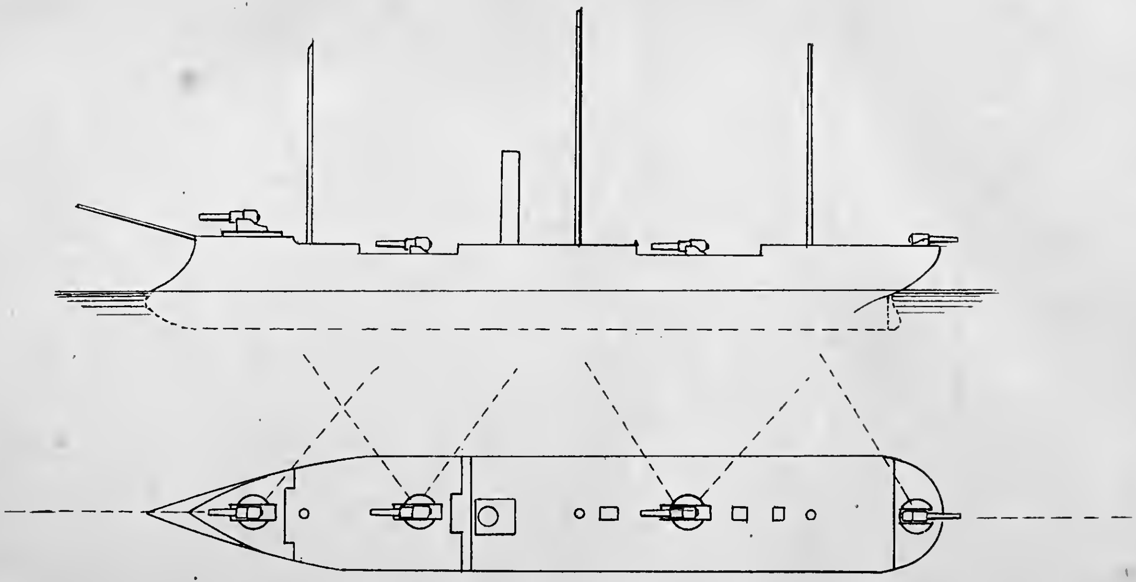
FIRST CLASS AVISO.

Type: Chasseur, Hussard, Labourdonnais, Bisson, Voltigeur, Lancier.

Length between perpendiculars	200 feet.
Outside beam at water-line	28 feet 5 inches.
Mean load-draught	11 feet.
Displacement	780 tons.
Area of immersed midship section	201.4 square feet.
Power developed by engine	849 horse-power.
Maximum speed	12.18 knots.
Coal supply	110 tons.
Distance attainable at 9 knots	3,000 miles.
Sail surface	8,855 square feet
Proportion of sail surface to midship section	25 to 1.
Number of crew	85.
Battery, 5½-inch caliber	4.



ECLAIREUR. RIGAULT DE GENOUILLY.



BISSON. VOLTIGEUR. LABOURDONNAIS.

CHASSEUR. HUSSARD. LANCIER

Fire directly ahead:
- Number of guns .... 1.
- Weight of metal thrown .... 46.5-pound shell.
- Effective range against unarmored ships .... 5,500 yards.

Fire abeam:
- Number of guns .... 4.
- Weight of metal thrown .... 185.6-pound shell.

Fire astern:
- Number of guns .... 1.
- Weight of metal thrown .... 46.5-pound shell.

Height of battery above water-line .... 8.3.

This vessel compares in displacement and measurements with the Flamingo type of English gunboats. The Flamingo has 16-centimeter bow and stern guns against 14-centimeters in the Chasseur. Their broadsides are two 16-centimeters and one 18-centimeter against four 14-centimeters. The battery, again, of the English vessel is the more powerful in all directions. The speed is 10 knots for the Flamingo and 12.18 for the Chasseur. Both batteries are entirely pivot-guns, carried amidships, the one, however, of the Chasseur being better placed, as it is center-pivoting. The Chasseur's topgallant forecastle is large enough to furnish good berthing accommodation.

FIRST CLASS AVISO.

Type: D'Estrees.

This type of vessel, laid down at the same time as the Infernet, has always been classed as a third-class cruiser. They were flush, like the Infernet, and of the same general class of broadside gunboats, with forward and after pivots, the rail dropping in this case as in the other. Of this type there were put into service the following vessels: D'Estrees, Beautemps-Beaupré, Bourzague, Dayot, Hamelin, Duchaffaut, Ducouedic, Forbin, and Hugon. Their dimensions are:

Length between perpendiculars	207 feet.
Outside beam at water-line	34 feet.
Mean load-draught	14 feet.
Maximum speed	12.3 knots.
Coal supply	220 tons.
Number of crew	150 men.

The battery is made up of two 16-centimeter guns, bow and stern pivots, and four 14-centimeter guns in broadside, making them, in battery power, hold a place between the Eclaireur and Chasseur, although the old type puts them in the rank of avisos.

TRANSPORT AVISO.

Type: Allier, Romanche, Drac, Nievre, Saone.

Length between perpendiculars	207 feet.
Outside beam at water-line	34.4 feet.
Mean load-draught	8.2 feet.
Displacement	451 tons.
Area of immersed midship section	161.4 square feet.
Power developed by engine	150 H. P., nominal.
Maximum speed	
Coal supply	180 tons.
Distance attainable at — knots	
Sail surface	1,302 square feet.
Proportion of sail surface to midship section	12 to 1.
Number of crew	
Carrying capacity	220 tons.
Battery, 5½ inch caliber	4.

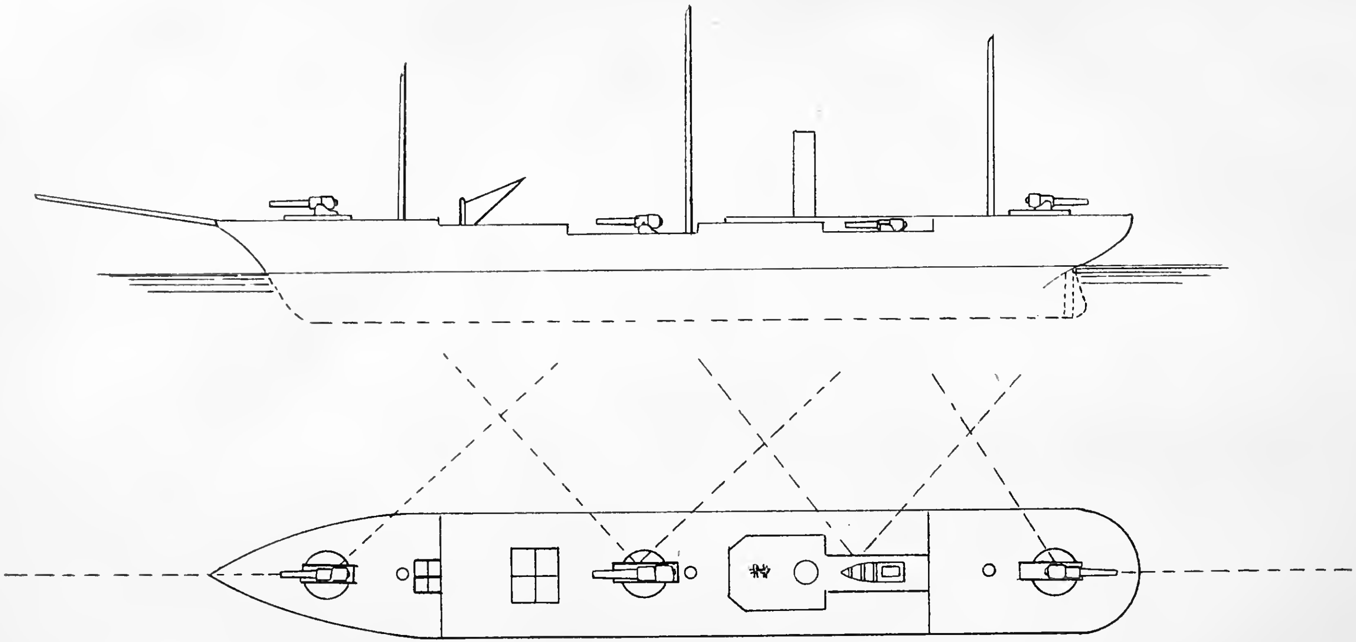
Fire directly ahead:	
Number of guns	1.
Weight of metal thrown	46.5 pounds shell.
Effective range against unarmored ships	5,500 yards.
Fire abeam:	
Number of guns	4.
Weight of metal thrown	185.6 pounds shell.
Fire astern:	
Number of guns	1.
Weight of metal thrown	46.5 pounds shell.
Height of battery above water-line	

This type of vessel, although scarcely belonging to the rank and file of cruisers, is well armed and possesses several points of interest. They have no counterpart in the English or other navies. For transports of their size they carry a very heavy battery, and seem to be a sort of general-utility craft. The long forecastle and poop give them excellent quarters, and, combined with their light draught, make them excellent for coast survey or special duty of a like nature. Their battery is heavy enough to class them with third-class cruisers, and is sufficient for most any emergency. Finally, their carrying power fits them for heavy work on the home stations, fit for carrying relief crews or stores to foreign stations, or, if desirable, for an increase of battery power. Although not of a very fine shape, the model of the Allier satisfied me better as being a hull worthy of imitation in our service than any that I have seen. As we are now accumulating a type of coast-survey steamers, it seems that this type would be as good as can be found for comfort and service in peace times and for good fighting gunboats during war. Cargo, space, and tonnage it seems might be given up to secure as powerful engines as the frame can stand and thus realize a 15-knot cruiser, good for other than service duty in peace times. This is the only type of French gunboat that has equal weight of battery with vessels of her displacement in the English navy.

FIRST-CLASS GUNBOAT.

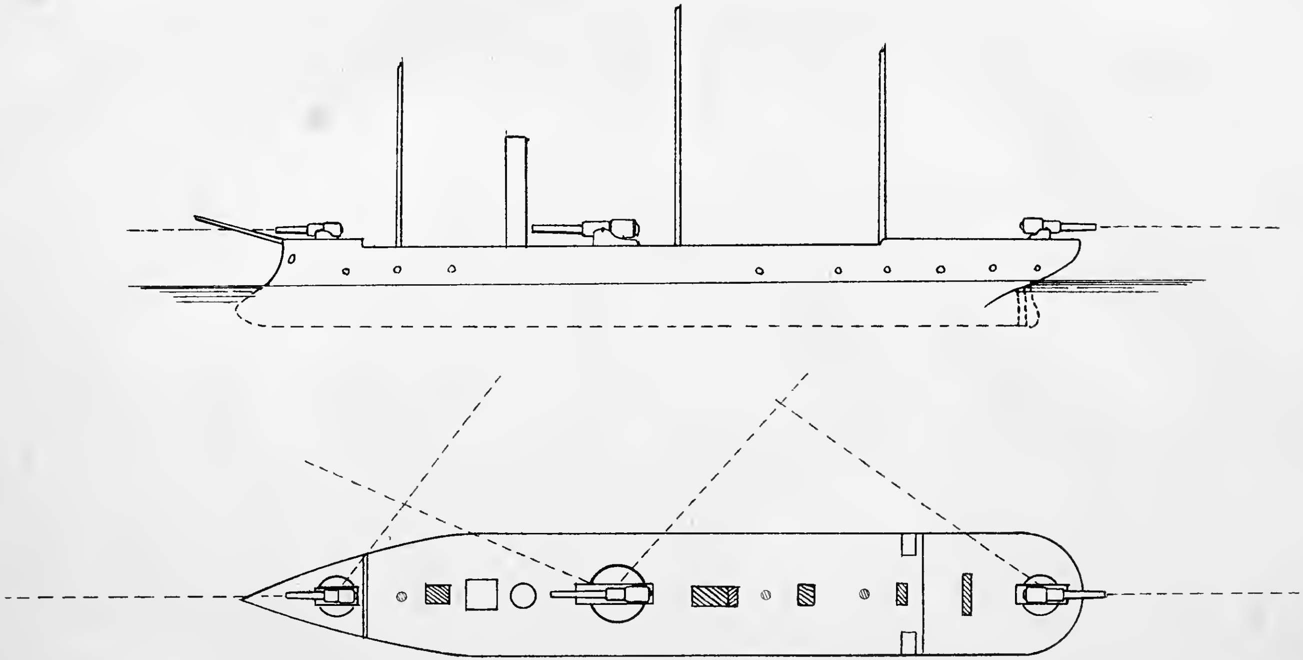
Type: Crocodile, Lutin, Lionne, Lynx.

Length between perpendiculars	141.7 feet.
Outside beam at water-line	23.9 feet.
Mean load-draught	8.23 feet.
Displacement	451 tons.
Area of immersed midship section	161.4 square feet.
Power developed by engine	457 horse-power.
Maximum speed	9.7 knots.
Coal supply	50 tons.
Distance attainable at —knots	
Sail surface	888 square feet.
Proportion of sail surface to midship section	18 to 1
Number of crew	70 men.
Battery:	
7¼-inch caliber	1.
4¾-inch caliber	2.
Fire directly ahead:	
Number of guns	1.
Weight of metal thrown	24 pounds shell.
Effective range against unarmored ships	3,000 yards.
Fire abeam:	
Number of guns	3.
Weight of metal thrown	213 pounds shell.
Fire astern:	
Number of guns	1.
Weight of metal thrown	24 pounds shell.
Height of battery above water-line	9 feet.



DRAC. NIEVRE. SAONE.

ALLIER. ROMANCHE.



CROCODILE. LUTIN. LYNX. LIONNE.

This type finds its place both in displacement and armament between the Coquette and the Arab. Its midship 19-centimeter gun is center pivoting. The slide rests on rollers on a heavy brass circle having a flange around the rim to steady the rollers. A rack is worked around the outer surface of this flange, in which travels a pinion connected with the rear of the slide. A small iron platform is hinged to the rear of the slide for the use of the loaders; this turns up against the carriage when not in use. The whole arrangement is very snug and leaves the gangways perfectly clean, but the elevation of the gun above the deck seems much too great, being sufficient to allow quite an angle of depression over the rail. It seems to me that the stability of the vessel would be much increased were the heavy circle sunk in the deck, and the gun allowed to sit deeper in the carriage. The light 10-centimeter guns give fire all around almost, but it is probable that they will soon be replaced by the Hotchkiss 47-millimeter gun. The speed is less than in corresponding types of English gunboats by half a knot.

SECOND-CLASS GUNBOAT.

Type: Aspic.

This type is of an earlier construction. The Aspic was on surveying service in Japan in 1867, where I saw her very often, and she is still there. The type differs from the Lutin in having a straight bow, and being flush fore and aft. Across the after part of her forecastle a shielded bulkhead runs consisting of a three-inch plate or a four-and-a-half-inch, I am not certain which, the gun firing over the rail completely *en barbette*. The gunboats of this type are the Aspic, Decidée, Pique, Surprise, Tactcque, Couleuvre, Diligente, Frelon, and Scorpion.

Length between perpendiculars	128 feet.
Outside beam at water line	21.6 feet.
Mean load-draught	8.4 feet.
Maximum speed	8 knots.
Coal supply	38 tons.
Number of crew	60 men.

Battery, 2 14-centimeter guns firing ahead and astern or in broadside.

LAUNCH GUNBOAT.

Type: Épee.

This type comes between the Staunch and Blazer. The dimensions are:

Length between perpendiculars	78.7 feet.
Outside beam at water-line	24.6 feet.
Mean load-draught	5 feet.
Displacement	178 tons.
Maximum speed	8.75 knots.
Number of crew	24 men.
Battery:	
24-centimeter gun	1.
12-centimeter gun, stern pivot	1.
Height of battery above water-line	5.9 feet.

These boats have double screws and engines. I can only find a record of two, Épee and Tromblon.

This completes the list of the French types with the exception of the old screw frigates and corvettes, a type of gunboat Renard, whose peculiarity consists in an enormous ram-bow intended to give buoyancy to

the forward part of the hull; the first-class unarmored transports, type Shamrock, the horse-transports, having a very light battery, and a type of gunboat in use in Cochin China which I cannot find described anywhere.

As with the iron-clads, I cannot intrude a conclusion as to the superiority of the types radically different from corresponding English ships. The French principle of securing the most perfect all-around fire from upper-deck batteries by means of half turrets, center pivots, and barbette stern guns, seems, however, far preferable to the English one of long pivot circles which list the ship, and ports at right angles to secure fore and aft and abeam fire. The first principle with the French is speed, and that they certainly attain. Their loss in battery strength is remedied in a manner by superior velocities of projectiles and rapidity of fire made possible by center pivoting and breech-loading. Roomy quarters for the crew seem to be a greater desideratum with the French than with either the English or ourselves. The Hotchkiss gun must be considered an addition to the batteries of all types of unarmored as well as iron-clad ships.

In closing, I call attention to a Spanish gunboat lately built by the Compagnie des Forges et Chantiers de la Mediterranée, the Jorge Juan, as showing the smallest type of ships to which the half turret for fore-and-aft fire has been applied. The dimensions of this vessel are:

Length between perpendiculars	209 feet.
Outside beam at water-line	29.6 feet.
Mean load-draught	12.3 feet.
Displacement	900 tons.
Maximum speed	13.45 knots.
Battery, 16 centimeters caliber	3.
Height of battery above water-line:	
Bow-chaser	17.7 feet.
Turret-guns	10.8 feet.

The bow-gun is a center-pivot on the topgallant forecastle, the slide working in a well to reduce the height. The broadside guns are in half turrets similar to the Tourville's, just abaft the forward back-stays. There is a broadside port just abaft the smoke-stack apparently in contemplation of the addition of another pair of broadside guns of lighter caliber.

This gunboat by her measurements is about the size of the English Daring, which carries two 18-centimeter guns amidships and two 16-centimeter for bow and stern fire.

In comparing power of fire: The Jorge Juan has three 16-centimeters for bow-fire to one 16-centimeter of the Daring; two 16-centimeters stern-fire to one of the other, and two 16-centimeters in broadside to two 18-centimeters of the other. The application of the turret in this case gives the perfection of horizontal firing angle, reaching a full 180°. It seems, however, as if it would have been possible to have placed them in *échelon* slightly so as to have given three 16-centimeters in broadside, or failing this the displacement seems to warrant a 16-centimeter gun amidships on the quarter-deck, which would have given an equal fire all around, and one of great weight for the size of the gunboat.

I am, sir, very respectfully, your obedient servant,

EDWARD W. VERY,
Lieutenant, United States Navy.

Commodore WILLIAM N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance.

RANGE TABLE.*

Class of gun .... 8-inch M. L. R.
Charge of powder .... 35 pounds, hexagonal.
Kind of projectile .... Battering shell.
Weight of projectile .... 180 pounds, filled.

Permanent angle of deflection for side sights .. 1° 50′.
Distance between sights (central) ...... 44.5 inches.
Initial velocity .... 1,450 ft. secs.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Drift.	Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Drift.
Yards.	° ′	*Secs.*	° ′	*Ft.-secs.*	*Yards.*	*Yards.*	° ′	*Secs.*	° ′	*Ft.-secs.*	*Yards.*
100	0 08	0. 21	0 08	1, 428	0. 01	2, 600	4 30	6. 52	5 40	1, 025	6. 53
200	0 16	0. 42	0 16	1, 406	0. 03	2, 700	4 44	6. 81	5 59	1, 016	7. 13
300	0 24	0. 63	0 25	1, 385	0. 07	2, 800	4 58	7. 11	6 18	1, 008	7. 76
400	0 32	0. 85	0 34	1, 364	0. 12	**2,817**	**5 00**	**7.16**	**6 21**	**1,007**	**7.86**
500	0 41	1. 07	0 43	1, 343	0. 19	2, 900	5 12	7. 41	6 37	1, 000	8. 41
600	0 50	1. 29	0 52	1, 323	0. 28	3, 000	5 26	7. 71	6 56	992	9. 09
700	0 59	1. 52	1 03	1, 304	0. 38	3, 100	5 40	8. 01	7 17	985	9. 80
709	**1 00**	**1.55**	**1 03**	**1,302**	**0.40**	3, 200	5 55	8. 32	7 38	978	10. 56
800	1 08	1. 75	1 14	1, 285	0. 51	**3,213**	**6 00**	**8.51**	**7 46**	**974**	**10.85**
900	1 18	1. 99	1 25	1, 266	0. 65	3, 300	6 10	8. 63	7 59	971	11. 35
1, 000	1 28	2. 23	1 36	1, 248	0. 82	3, 400	6 25	8. 94	8 20	964	12. 16
1, 100	1 38	2. 47	1 47	1, 230	1. 00	3. 500	6 40	9. 25	8 41	957	13. 01
1, 200	1 48	2. 72	2 00	1, 213	1. 21	3, 600	6 55	9. 56	9 02	951	13. 88
1, 300	1 58	2. 97	2 13	1, 197	1. 43	**3,613**	**7 00**	**9.70**	**9 11**	**918**	**14.21**
1,311	**2 00**	**3.00**	**2 14**	**1.195**	**1.46**	3, 700	7 10	9. 88	9 23	944	14. 78
1, 400	2 09	3. 22	2 26	1, 181	1. 68	3, 800	7 26	10. 20	9 46	938	15. 74
1, 500	2 20	3. 48	2 41	1, 165	1. 95	3, 900	7 42	10. 52	10 09	932	16. 73
1, 600	2 31	3. 74	2 56	1, 149	2. 25	4, 000	7 58	10. 84	10 32	926	17. 75
1, 700	2 42	4. 00	3 11	1, 134	2. 56	**4,017**	**8 00**	**10.90**	**10 36**	**925**	**17.90**
1, 800	2 53	4. 27	3 26	1, 120	2. 90	4, 100	8 14	11. 16	10 55	920	18. 80
1,863	**3 00**	**4.44**	**3 33**	**1,111**	**3.12**	4, 200	8 30	11. 49	11 18	914	19. 87
1, 900	3 04	4. 54	3 41	1, 106	3. 25	4, 300	8 46	11. 82	11 41	909	20. 98
2, 000	3 16	4. 81	3 56	1, 093	3. 65	**4,377**	**9 00**	**12.08**	**12 01**	**904**	**21.92**
2, 100	3 28	5. 09	4 13	1, 080	4. 06	4, 400	9 04	12. 15	12 04	903	22. 20
2, 200	3 40	5. 37	4 30	1, 067	4. 50	4, 500	9 22	12. 48	12 29	898	23. 44
2, 300	3 52	5. 65	4 47	1. 056	4. 96	4, 600	9 40	12. 82	12 54	892	24. 73
2.365	**4 00**	**5.83**	**4 57**	**1,049**	**5.28**	4, 700	9 58	13. 16	13 19	887	26. 04
2, 400	4 04	5. 94	5 04	1, 045	5. 45	**4,723**	**10 00**	**13.26**	**13 26**	**885**	**26.25**
2. 500	4 16	6. 23	5 21	1, 035	5. 95						

*Computed by Lieut. John P. Merrell, U. S. N.

RANGE TABLE.*

Class of gun .... 8-inch M. L. R.
Charge of powder .... 25 pounds, hexagonal.
Kind of projectile .... Shell.
Weight of projectile .... 180 pounds, filled.

Permanent angle of deflection for side sights 1° 50′.
Distance between sights (central) ..... 44.5 inches.
Initial velocity .... 1,200 ft. secs.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Drift.	Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Drift.
Yards.	° ′	*Secs.*	° ′	*Ft.-secs.*	*Yards.*	*Yards.*	° ′	*Secs.*	° ′	*Ft.-secs.*	*Yards.*
100	0 11	0. 25	0 11	1, 184	1. 04	1, 900	4 20	5. 33	4 55	979	4. 59
200	0 23	0. 51	0 23	1, 168	0. 07	2, 000	4 36	5. 64	5 14	972	5. 13
300	0 35	0. 77	0 35	1, 152	0. 12	2, 100	4 52	5. 95	5 34	965	5. 70
400	0 47	1. 03	0 48	1, 138	0. 19	**2.155**	**5 00**	**6.12**	**5 45**	**962**	**6.01**
495	**1 00**	**1.28**	**1 02**	**1,124**	**0.28**	2, 200	5 08	6. 26	5 54	959	6. 30
500	1 00	1. 29	1 02	1, 123	0. 28	2, 300	5 24	6. 57	6 14	952	6. 93
600	1 13	1. 56	1 16	1, 109	0. 40	2, 400	5 40	6. 89	6 34	946	7. 59
700	1 26	1. 83	1 31	1, 096	0. 55	2, 500	5 57	7. 21	6 56	939	8. 29
800	1 39	2. 11	1 46	1, 082	0. 73	**2,521**	**6 00**	**7.29**	**7 01**	**938**	**8.43**
900	1 53	2. 39	2 02	1, 070	0. 94	2, 600	6 14	7. 53	7 18	933	9. 03
949	**2 00**	**2.52**	**2 09**	**1,064**	**1.06**	2, 700	6 31	7. 85	7 40	927	9. 80
1, 000	2 07	2. 67	2 18	1, 058	1. 18	2, 800	6 48	8. 17	8 02	921	10. 61
1, 100	2 21	2. 95	2 34	1, 047	1. 44	**2,867**	**7 00**	**8.40**	**8 15**	**917**	**11.18**
1, 200	2 35	3. 24	2 50	1, 037	1. 73	2, 900	7 06	8. 50	8 27	916	11. 47
1. 300	2 49	3. 53	3 07	1, 027	2. 05	3, 000	7 24	8. 83	8 46	910	12. 36
1.373	**3 00**	**3.75**	**3 19**	**1,021**	**2.30**	3, 100	7 42	9. 16	9 09	904	13. 29
1, 400	3 04	3. 83	3 24	1, 018	2. 50	**3,199**	**8 00**	**9.49**	**9 32**	**899**	**14,25**
1, 500	3 19	4. 13	3 41	1, 010	2. 78	3, 200	8 00	9. 49	9 32	899	14. 25
1, 600	3 34	4. 43	3 58	1, 002	3. 19	3, 300	8 18	9. 83	9 55	893	15. 23
1, 700	3 49	4. 73	4 17	994	3. 62	3, 400	8 37	10. 17	10 19	888	16. 30
1,774	**4 00**	**4.95**	**4 31**	**988**	**3.96**	3. 500	8 56	10. 51	10 43	883	17. 39
1, 800	4 04	5. 03	4 36	986	4. 08	**3,522**	**9 00**	**10.58**	**10 49**	**881**	**17.64**

*Computed by Lieut. John P. Merrell, U. S. N.

RANGE TABLE.*

Class of gun ....80-pounder (Parrott), B. L. R.
Charge of powder ....10 pounds, rifle.
Kind of projectile ....Short shell.
Weight of projectile..............80 pounds, filled.

Permanent angle of deflection for tangent sight.
Distance between sights.
Initial velocity of shell ....1,250 ft. secs.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.
Yards.	° ′	*Seconds.*	° ′	*Ft.-secs.*	*Yards.*	° ′	*Seconds.*	° ′	*Ft.-secs.*
100	0 11	0.24	0 11	1,225	**1,790**	**4 00**	**5.03**	**4 46**	**953**
200	0 22	0.49	0 23	1,201	1,800	4 02	5.06	4 47	952
300	0 34	0.74	0 35	1,177	1,900	4 18	5.38	5 08	943
400	0 46	1.00	0 48	1,155	2,000	4 34	5.70	5 30	935
500	0 58	1.26	1 01	1,134	2,100	4 51	6.02	5 52	926
521	**1 00**	**1.32**	**1 03**	**1,129**	**2,154**	**5 00**	**6.20**	**6 04**	**921**
600	1 10	1.53	1 14	1,113	2,200	5 08	6.34	6 14	917
700	1 23	1.80	1 29	1,094	2,300	5 26	6.67	6 37	909
800	1 36	2.08	1 44	1,075	2,400	5 44	7.00	7 00	901
900	1 49	2.36	2 00	1,058	**2,494**	**6 00**	**7.32**	**7 23**	**894**
981	**2 00**	**2.59**	**2 13**	**1,046**	2,500	6 02	7.34	7 24	893
1,000	2 02	2.64	2 17	1,043	2,600	6 20	7.68	7 48	886
1,100	2 16	2.93	2 34	1,028	2,700	6 38	8.02	8 13	878
1,200	2 30	3.23	2 51	1,016	2,800	6 57	8.36	8 38	871
1,300	2 45	3.53	3 09	1,004	**2,821**	**7 00**	**8.43**	**8 43**	**869**
1,400	3 00	3.83	3 28	992	2,900	7 16	8.71	9 03	863
1,401	**3 00**	**3.83**	**3 28**	**992**	3,000	7 35	9.06	9 29	856
1,500	3 15	4.13	3 47	982	3,100	7 54	9.41	9 55	849
1,600	3 30	4.44	4 06	972	**3,133**	**8 00**	**9.53**	**10 05**	**847**
1,700	3 46	4.75	4 26	962					

* Computed by Lieut. J. P. Merrell, U. S. N.

RANGE TABLE.*

Class of gun ......100-pounder (Parrott), M. L. R.
Charge of powder ....10 pounds, rifle.
Kind of projectile ....Parrott shell.
Weight of projectile ....100 pounds, filled.

Permanent angle of deflection for tangent sight.
Distance between sights.
Initial velocity of shell ....1,080 ft. secs.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Range.	Elevation.	Time of flight.	Angle of fall.	Remaining velocity.
Yards.	° ′	*Seconds.*	° ′	*Ft.-secs.*	*Yards.*	° ′	*Seconds.*	° ′	*Ft.-secs.*
100	0 14	0.28	0 14	1,066	1,700	4 36	5.15	5 09	923
200	0 29	0.56	0 29	1,053	1,800	4 54	5.48	5 24	916
300	0 44	0.85	0 44	1,041	**1,835**	**5 00**	**5.59**	**5 33**	**914**
400	0 59	1.14	1 00	1,029	1,900	5 12	5.81	5 47	910
405	**1 00**	**1.16**	**1 01**	**1,029**	2,000	5 31	6.14	6 10	903
500	1 14	1.44	1 16	1,019	2,100	5 50	6.47	6 33	897
600	1 30	1.73	1 33	1,009	**2,158**	**6 00**	**6.67**	**6 45**	**893**
700	1 46	2.03	1 50	1,000	2,200	6 09	6.81	6 56	891
788	**2 00**	**2.29**	**2 06**	**992**	2,300	6 28	7.15	7 19	885
800	2 02	2.33	2 08	991	2,400	6 47	7.49	7 42	879
900	2 18	2.63	2 26	983	**2,470**	**7 00**	**7.73**	**7 59**	**875**
1,000	2 34	2.94	2 44	974	2,500	7 07	7.83	8 08	873
1,100	2 51	3.25	3 03	966	2,600	7 27	8.18	8 34	867
1,151	**3 00**	**3.41**	**3 13**	**962**	2,700	7 47	8.53	9 00	861
1,200	3 08	3.56	3 22	959	**2,767**	**8 00**	**8.76**	**9 13**	**857**
1,300	3 25	3.87	3 41	951	2,800	8 07	8.88	9 26	855
1,400	3 42	4.19	4 00	944	2,900	8 27	9.23	9 52	850
1,500	4 00	4.51	4 21	937	3,000	8 48	9.58	10 18	844
1,500	**4 00**	**4.51**	**4 21**	**937**	**3,056**	**9 00**	**9.78**	**10 32**	**841**
1,600	4 18	4.83	4 42	930	3,100	9 09	9.94	10 47	839

* Computed by Lieut. J. P. Merrell, U. S. N.

RANGE TABLE.*

Class of gun ....100-pounder (Parrott) M. L. R.
Charge of powder.....................8 pounds, rifle.
Kind of projectile.....................Parrott shell.
Weight of projectile ....80 pounds, filled.

Permanent angle of deflection for tangent sight .
Distance between sights ....
Initial velocity of shell.................1140 ft. sec.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Angle of elevation.	Drift.	Time of flight.	Angle of fall.	Remaining velocity.	Range.	Angle of elevation.	Drift.	Time of flight.	Angle of fall.	Remaining velocity.
Yds.	° ′	*Yds.*	*Secs.*	° ′	*Ft.-secs.*	*Yds.*	° ′	*Yds.*	*Secs.*	° ′	*Ft.-secs.*
100	0 13	0.01	0.28	0 14	1,129	**1,888**	**5 00**	**4.31**	**5.79**	**5 53**	**988**
200	0 26	0.04	0.55	0 28	1,119	1,900	5 02	4.37	5.83	5 56	985
300	0 40	0.09	0.82	0 41	1,109	2,000	5 22	4.89	6.18	6 22	980
400	0 54	0.17	1.10	0 56	1,099	2,100	5 42	5.46	6.54	6 48	975
443	**1 00**	**0.20**	**1.23**	**1 02**	**1,095**	**2,188**	**6 00**	**5.99**	**6.86**	**7 13**	**971**
500	1 14	0.26	1.38	1 11	1,090	2,200	6 02	6.06	6.90	7 16	970
600	1 23	0.38	1.66	1 27	1,081	2,300	6 23	6.69	7.26	7 44	965
700	1 38	0.54	1.95	1 44	1,072	2,400	6 44	7.38	7.63	8 13	960
800	1 53	0.69	2.25	2 01	1,063	**2,470**	**7 00**	**7.88**	**7.90**	**8 33**	**957**
845	**2 00**	**0.72**	**2.39**	**2 10**	**1,058**	2,500	7 06	8.09	8.01	8 42	955
900	2 08	0.88	2.55	2 19	1,054	2,600	7 28	8.85	8.39	9 12	950
1,000	2 24	1.10	2.86	2 38	1,046	2,700	7 51	9.66	8.78	9 44	945
1,100	2 40	1.34	3.17	2 58	1,038	**2,737**	**8 00**	**9.98**	**8.94**	**9 56**	**943**
1,200	2 58	1.62	3.48	3 17	1,030	2,800	8 14	10.51	9.18	10 17	940
1,217	**3 00**	**1.67**	**3.55**	**3 21**	**1,029**	2,900	8 38	11.41	9.58	10 50	935
1,300	3 14	1.92	3.80	3 38	1,022	**2,987**	**9 00**	**12.24**	**9.95**	**11 19**	**931**
1,400	3 31	2.25	4.12	3 59	1,015	3,000	9 03	12.36	9.99	11 24	931
1,500	3 49	2.62	4.45	4 21	1,009	3,100	9 28	13.34	10.41	11 59	927
1,563	**4 00**	**2.86**	**4.67**	**4 35**	**1,007**	3,200	9 53	14.38	10.83	12 34	923
1,600	4 07	3.00	4.79	4 44	1,003	**3,228**	**10 00**	**14.68**	**10.95**	**12 44**	**920**
1,700	4 25	3.42	5.13	5 07	997	3,300	10 18	15.45	11.25	13 10	919
1,800	4 43	3.88	5.48	5 31	991						

*Computed by Ensign R. F. Nicholson, U. S. N.

RANGE TABLE.*

Class of gun ....60-pounder (Parrott) M. L. R.
Charge of powder ....6 pounds rifle-powder
Kind of projectile ....Shell, service-pattern.
Weight of projectile ....48 pounds, filled.

Permanent angle of deflection for tangent sight.......................................1° 24′.
Distance between sights ....39.33 in.
Angle of jump, directing-bar carriage ......0° 27′.
Initial velocity of shell ....1,320 ft. sec.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.	Drift.	Time of flight.	Marks on the sight-bar.	Marks on the sliding-leaf.	No. of turns of milled head.
Yards.	° ′	*Yards.*	*Seconds.*	*Inches.*		
100	− 0 14	0.	0.26	− 0.32	0.00	0
200	− 0 01	0.	0.52	− 0.01	0.00	0
204	**0 00**	**0.**	**0.53**	**0.00**	**0.00**	**0**
300	+ 0 13	6.03	0.78	+ 0.15	0.004	0
400	0 26	0.07	1.05	0.30	0.007	0¼
500	0 39	0.13	1.32	0.45	0.010	0¼
600	0 52	0.22	1.60	0.60	0.013	0½
656	**1 00**	**0.28**	**1.77**	**0.69**	**0.016**	**0¾**
700	1 05	0.32	1.88	0.75	0.017	0¾
800	1 18	0.44	2.16	0.90	0.021	1.0
900	1 31	0.58	2.44	1.05	0.025	1.0
1,000	1 45	0.75	2.72	1.20	0.029	1¼
1,100	1 59	0.93	3.00	1.36	0.033	1¼
1,109	**2 00**	**0.95**	**3.03**	**1.37**	**0.033**	**1¼**
1,200	2 13	1.13	3.29	1.52	0.037	1½
1,300	2 28	1.36	3.59	1.69	0.041	1¾
1,400	2 43	1.60	3.90	1.86	0.045	1¾
1,500	2 58	1.87	4.21	2.03	0.049	2.0
1,517	**3 00**	**1.89**	**4.26**	**2.061**	**0.050**	**2.0**
1,600	3 13	2.19	4.52	2.21	0.053	2¼
1,700	3 28	2.51	4.84	2.38	0.057	2½
1,800	3 44	2.87	5.16	2.56	0.062	2½
1.900	**4 00**	**3.24**	**5.48**	**2.75**	**0.067**	**2¾**

*Computed by Lieut. J. R. Selfridge, U. S. N.

RANGE TABLE—Continued.

Range.	Elevation.	Drift.	Time of flight.	Marks on the sight-bar.	Marks on the sliding-leaf.	No. of turns of milled head.
Yards.	° ′	*Yards.*	*Seconds.*	*Inches.*		
2,000	4 17	3.65	5.80	2.94	0.072	3
2,100	4 34	4.09	6.13	3.14	0.077	3¼
2,200	4 52	4.56	6.47	3.35	0.082	3½
2,242	**5 00**	**4.81**	**6.64**	**3.44**	**0.085**	**3½**
2,300	5 11	5.08	6.81	3.57	0.087	3¾
2,400	5 30	5.62	7.15	3.79	0.092	3¾
2,500	5 49	6.19	7.50	4.01	0.097	4
2,552	**6 00**	**6.50**	**7.67**	**4.13**	**0.100**	**4¼**
2,600	6 08	6.79	7.85	4.23	0.102	4½
2,700	6 27	7.41	8.21	4.45	0.107	4½
2,800	6 46	8.06	8.58	4.67	0.112	4¾
2,865	**7 00**	**8.51**	**8.82**	**4.83**	**0.115**	***4¾**
2,900	7 06	8.76	8.95	4.90	0.117	5
3,000	7 26	9.48	9.33	5.13	0.123	5¼
3,100	7 46	10.24	9.72	5.36	0.129	5½
3,165	**8 00**	**10.74**	**9.97**	**5.53**	**0.132**	**5¾**
3,200	8 06	11.02	10.11	5.59	0.134	5¾
3,300	8 26	11.83	10.50	5.83	0.140	5¾
3,400	8 46	12.66	10.89	6.07	0.146	6
3,465	**9 00**	**13.22**	**11.14**	**6.23**	**0.150**	**6¼**
3,500	9 06	13.53	11.28	6.31	0.152	6¼
3,600	9 27	14.44	11.67	6.55	0.158	6½
3,700	9 48	15.40	12.06	6.79	0.164	6¾
3,757	**10 00**	**16.00**	**12.29**	**6.94**	**0.168**	**7**
3,800	10 09	16.38	12.45	7.04	0.170	7
3,900	10 31	17.40	12.85	7.30	0.176	7¼
4,000	10 55	18.51	13.25	7.58	0.182	7½
4,020	**11 00**	**18.75**	**13.33**	**7.65**	**0.183**	**7½**
4,100	11 20	19.69	13.65	7.88	0.188	7¾
4,200	11 45	20.87	14.06	8.18	0.195	8
4,260	**12 00**	**21.64**	**14.31**	**8.36**	**0.200**	**8¼**
4,300	12 10	22.15	14.47	8.48	0.202	8½
4,400	12 35	23.45	14.89	8.78	0.209	8¾
4,500	**13 00**	**24.74**	**15.31**	**9.08**	**0.216**	**9**
4,600	13 25	26.09	15.74	9.38	0.223	9¼
4,700	13 51	27.50	16.18	9.69	0.230	9½
4,735	**14 00**	**27.99**	**16.33**	**9.81**	**0.233**	**9¾**
4,800	14 17	28.94	16.62	10.01	0.237	9¾
4,900	14 43	30.42	17.07	10.33	0.244	10
4,963	**15 00**	**31.40**	**17.30**	**10.55**	**0.249**	**10¼**
5,000	15 10	31.97	17.53	10.66	0.252	10½

NOTE.—The line of sight is parallel to line of fire when the sliding-leaf is two (2) full turns from the outer edge, and from construction of sight will not allow for drift at a greater range than 2,900 yards.

* Limit of sliding-leaf for 60-pounder.

RANGE TABLE.*

Class of gun ....20-pounder, B. L. R. (bronze).
Charge of powder ....2 pounds, cannon.
Kind of projectile......Service shell, lead banded.
Weight of projectile ....18 pounds, filled.

Permanent angle of deflection for tangent sight..2° 12′.
Distance between sights.................... 24.23 in.
Angle of jump, broadside carriage.......... 0° 24′.
Initial velocity of shell .... 1.070 ft. sec.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Angle of elevation.	Drift.	Time of flight.	Marks on the sight-bar.	Range.	Angle of elevation.	Drift.	Time of flight.	Marks on the sight-bar.
Yards.	° ′	*Yards.*	*Seconds.*	*Inches.*	*Yards.*	° ′	*Yards.*	*Seconds.*	*Inches.*
400	0 42	1.4	1.3	0.231	1,800	4 43	7.6	5.8	1.981
500	0 55	1.6	1.6	0.348	**1.892**	**5 00**	**8.1**	**6.1**	**2.119**
540	**1 00**	**1.7**	**1.7**	**0.423**	1,900	5 03	8.2	6.2	2.120
600	1 09	1.9	1.9	0.468	2,000	5 23	8.9	6.6	2.263
700	1 26	2.2	2.3	0.588	2,100	5 44	9.5	7.0	2.410
800	1 42	2.6	2.6	0.709	**2,177**	**6 00**	**10.0**	**7.3**	**2.516**
900	1 58	2.9	2.9	0.831	2,200	6 05	10.2	7.4	2.562
910	**2 00**	**3.0**	**2.9**	**0.846**	2,300	6 28	11.0	7.8	2.719
1,000	2 15	3.3	3.2	0.953	2,400	6 52	11.9	8.2	2.882
1,100	2 32	3.8	3.5	1.076	**2,430**	**7 00**	**12.3**	**8.3**	**2.975**
1,200	2 49	4.3	3.8	1.200	2,500	7 17	13.0	8.6	3.055
1.260	**3 00**	**4.5**	**4.0**	**1.270**	2,600	7 42	14.3	9.0	3.238
1,300	3 07	4.8	4.1	1.326	**2,673**	**8 00**	**15.9**	**9.3**	**3.405**
1,400	3 25	5.3	4.4	1.454	2,700	8 07	16.4	9.4	3.428
1,500	3 44	5.9	4.8	1.583	2,800	8 33	19.3	9.8	3.627
1.587	**4 00**	**6.3**	**5.1**	**1.694**	**2.900**	**9 00**	**22.9**	**10.2**	**3.837**
1,600	4 03	6.4	5.2	1.713	3,000	9 28	26.6	10.6	4.047
1,700	4 23	7.0	5.5	1.846	**3,100**	**10 00**	**30.4**	**11.1**	**4.272**

* By Lieut. J. R. Selfridge, U. S. N.

RANGE TABLE.*

Class of gun 3-inch B. L. R. (howitzer).
Charge of powder ....16 ounces, cannon.
Kind of projectile ....Shell.
Weight of projectile ....7 pounds, filled.

Permanent angle of deflection for tangent sight .... 2° 40′ 00″.
Distance between sights..............19.06 inches.
Angle of jump ....0° 29′ 25″.
Initial velocity........................1.246 ft. sec.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.	Time of flight.	Drift.	Marks on the sight-bar.	Range.	Elevation.	Time of flight.	Drift.	Marks on the sight-bar.
Yards.	° ′ ″	*Seconds.*	*Yards.*	*Inches.*	*Yards.*	° ′ ″	*Seconds.*	*Yards.*	*Inches.*
100	− 0 05 24	.31	.015	−0.02	**2,846**	**8 00 00**	**9.75**	**18.45**	**2.68**
200	+ 0 07 48	.62	.059	+0.05	2,900	8 15 00	9.98	19.24	2.76
300	0 21 36	.93	.128	0.12	3,000	8 40 12	10.40	20.90	2.90
400	0 35 24	1.24	.237	0.19	**3.083**	**9 00 00**	**10.75**	**22.46**	**3.02**
500	0 49 12	1.56	.374	0.26	3,100	9 06 00	10.82	22.66	3.05
579	**1 00 00**	**1.85**	**.471**	**0.33**	3,200	9 31 48	11.25	24.55	3.20
600	1 03 00	1.88	.546	0.34	3,300	9 59 24	11.69	26.51	3.35
700	1 16 48	2.20	.751	0.42	**3,305**	**10 00 00**	**11.76**	**26.73**	**3.36**
800	1 31 12	2.51	.995	0.50	3,400	10 27 00	12.13	28.53	3.50
900	1 45 36	2.83	1.27	0.58	3,500	10 55 12	12.59	30.71	3.66
1.000	**2 00 00**	**3.15**	**1.59**	**0.66**	**3,520**	**11 00 00**	**12.67**	**30.83**	**3.71**
1,100	2 14 24	3.47	1.95	0.74	3,600	11 24 00	13.05	32.97	3.83
1,200	2 28 48	3.79	2.36	0.82	3,700	11 54 00	13.53	35.36	4.00
1,300	2 43 48	4.11	2.82	0.90	**3,720**	**12 00 00**	**13.63**	**36.02**	**4.06**
1,400	2 58 48	4.44	3.32	0.99	3,800	12 25 12	14.01	37.91	4.18
1,401	**3 00 00**	**4.50**	**3.40**	**1.00**	3,900	12 57 00	14 51	40.55	4.37
1,500	3 14 24	4.78	3.88	1.08	**3,912**	**13 00 00**	**14.57**	**40.98**	**4.41**
1,600	3 30 36	5.12	4.47	1.17	4,000	13 29 24	15.03	43.27	4.56
1,700	3 47 24	5.46	5.11	1.26	**4,090**	**14 00 00**	**15.51**	**46.00**	**4.75**
1,762	**4 00 00**	**5.61**	**5.73**	**1.33**	4,100	14 01 48	15.57	46.17	4.76
1,800	4 04 48	5.80	5.89	1.36	4,200	14 36 36	16.12	39.21	4.97
1,900	4 23 24	6.14	6.67	1.47	**4,260**	**15 00 00**	**16.46**	**51.35**	**5.11**
2,000	4 43 12	6.49	7.54	1.58	4,300	15 12 00	16.68	52.41	5.18
2.082	**5 00 00**	**6.70**	**8.45**	**1.67**	4,400	15 46 48	17.25	55.73	5.40
2,100	5 03 36	6.85	8.57	1.69	**4.427**	**16 00 00**	**17.38**	**56.83**	**5.47**
2,200	5 25 12	7.22	9.65	1.81	4,500	16 24 00	17.83	59.18	5.62
2,300	5 46 46	7.59	10.81	1.93	**4,587**	**17 00 00**	**18.35**	**62.46**	**5.83**
2.348	**6 00 00**	**7.80**	**11.43**	**2.00**	4,600	17 01 48	18.42	62.75	5.85
2,400	6 10 24	7.98	12.03	2.06	4,700	17 41 24	19.05	66.52	6.09
2,500	6 36 00	8.37	13.32	2.20	**4,740**	**18 00 00**	**19.22**	**68.22**	**6.20**
2,592	**7 00 00**	**8.70**	**14.68**	**2.33**	4,800	18 21 00	19.68	70.38	6.34
2,600	7 00 36	8.76	14.70	2.34	**4,891**	**19 00 00**	**20.30**	**74.16**	**6.57**
2,700	7 25 24	9.16	16.13	2.48	4,900	19 01 12	20.35	74.38	6.59
2,800	7 49 48	9.57	17.66	2.62					

* By Ensign R. F. Nicholson, U. S. N.

RANGE TABLE.

Class of gun........3-inch B. L. R. rifle-howitzer.
Charge of powder..............12 ounces, cannon.
Kind of projectile............................Shell.
Weight of projectile..............7 pounds, filled.

Permanent angle of deflection for tangent sight.................................... 2° 00′ 00″.
Distance between sights...............13.75 inches.
Angle of jump...............................0° 55′.
Initial velocity of shell.................1,179 ft. sec.

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Elevation.*	Time of flight.	Drift.	Marks on the sight-bar.
Yards.	° ′ ″	*Seconds.*	*Yards.*	*Inches.*
100	− 0 21 00	0. 30	0. 02	− 0. 09
200	− 0 06 00	0. 60	0. 07	− 0. 03
240	**0 00 00**	**0.72**	**0.11**	**0.00**
300	+ 0 09 00	0. 90	0. 16	+ 0. 03
400	0 34 36	1. 20	0. 25	0. 09
500	0 40 48	1. 50	0. 46	0. 16
600	0 57 36	1. 82	0. 69	0. 23
610	**1 00 00**	**1.88**	**0.72**	**0.24**
700	1 14 24	2. 14	0. 92	0. 30
800	1 31 12	2. 46	1. 19	0. 37
900	1 48 36	2. 78	1. 50	0. 44
960	**2 00 00**	**2.96**	**1.70**	**0.48**
1, 000	2 06 36	3. 10	1. 84	0. 51
1, 100	2 24 06	3. 44	2. 22	0. 58
1, 200	2 43 12	3. 78	2. 66	0. 65
1.292	**3 00 00**	**4.10**	**3.08**	**0.72**
1, 300	3 01 48	4. 13	3. 13	0. 72
1, 400	3 20 24	4. 50	3. 63	0. 80
1, 500	3 39 00	4. 89	4. 17	0. 88
1, 600	3 58 48	5. 28	4. 77	0. 96
1.605	**4 00 00**	**5.29**	**4.80**	**0.97**
1, 700	4 19 12	5. 68	5. 42	1. 04
1, 800	4 39 36	6. 11	6. 11	1. 12
1.900	**5 00 00**	**6.54**	**6.84**	**1.20**
2, 000	5 22 12	6. 98	7. 65	1. 29
2, 100	5 46 48	7. 42	8. 55	1. 38
2.143	**6 00 00**	**7.62**	**8.97**	**1.43**
2, 200	6 12 00	7. 87	9. 56	1. 48
2, 300	6 39 00	8. 33	10. 58	1. 58
2.374	**7 00 00**	**8.69**	**11.48**	**1.67**
2, 400	7 06 00	8. 79	11. 69	1. 69
2, 500	7 33 00	9. 25	12. 83	1. 80
2.600	**8 00 00**	**9.71**	**14.07**	**1.91**
2, 700	8 27 00	10. 28	15. 34	2. 02
2, 800	8 54 00	10. 65	16. 67	2. 14
2.810	**9 00 00**	**10.70**	**16.81**	**2.17**
2, 900	9 21 36	11. 12	18. 07	2. 26
3, 000	9 49 12	11. 59	19. 52	2. 38
3,033	**10 00 00**	**11.76**	**20.02**	**2.43**
3, 100	10 17 24	12. 06	21. 04	2. 50
3, 200	10 45 36	12. 54	22. 60	2. 62
3.250	**11 00 00**	**12.80**	**23.43**	**2.68**
3, 300	11 13 48	13. 03	24. 25	2. 74
3, 400	11 42 00	13. 52	25. 93	2. 86
3,460	**12 00 00**	**13.82**	**26.97**	**2.93**
3, 500	12 10 12	14. 02	27. 67	2. 98
3, 600	12 38 24	14. 52	29. 47	3. 10
3,674	**13 00 00**	**14.89**	**30.85**	**3.18**
3, 700	13 06 36	15. 02	31. 32	3. 22
3, 800	13 34 48	15. 53	33. 22	3. 34
3,878	**14 00 00**	**15.92**	**34.87**	**3.44**
3, 900	14 07 12	16. 05	35. 33	3. 47
4, 000	14 41 24	16. 58	37. 58	3. 61
4,050	**15 00 00**	**16.85**	**38.80**	**3.68**
4, 100	15 19 12	17. 14	40. 03	3. 77
4,200	**16 00 00**	**17.70**	**42.68**	**3.94**
4, 300	16 43 12	18. 28	45. 49	4. 12
4.338	**17 00 00**	**18.50**	**46.63**	**4.18**
4, 400	17 28 48	18. 88	48. 49	4. 32
4.469	**18 00 00**	**19.30**	**50.63**	**4.47**
4, 500	18 14 24	19. 48	51. 56	4. 53
4,593	**19 00 00**	**20.05**	**54.44**	**4.75**
4, 600	19 04 12	20. 08	54. 66	4. 76
4, 700	19 58 48	20. 69	57. 76	5. 00
4,704	**20 00 00**	**20.71**	**57.80**	**5.01**

*By Ensign R. F. Nicholson, U. S. N.

RANGE TABLE.*

Class of gun	XI-inch smooth-bore.	Distance between sights	48 inches.
Charge of powder	15 pounds, cannon.	Initial velocity of shell	1,240 ft. sec.
Kind of projectile	Service-shell.		
Weight of projectile	135.6 pounds, filled.		

[Ranges referred to the horizontal plane through the trunnions.]

Range.	Angle of elevation.		Time of flight.	Angle of fall.		Remaining velocity.	Dangerous zone for vessels.†	Ordinates of the trajectory.	Co-ordinates of the highest points of the trajectory.		Marks on the sight-bar (side).	Marks on the sight-bar (central).
									x	y		
Yards.	°	'	Secs.	°	'	Ft.-secs.	Feet.	Yards.	Yards.	Yards.	Inches.	Inches.
400	0	49	1. 1	0	54	1, 048	1, 200	168.	240	1	0. 627	0. 783
500	1	03	1. 4	1	12	1, 000	1, 500	208.	300	2	0. 806	1. 004
600	1	17	1. 7	1	31	967	1, 800	247. 4	360	4	0. 985	1. 224
700	1	33	2. 0	1	52	929	2, 100	284. 6	420	5	1. 191	1. 474
800	1	49	2. 3	2	16	894	505	321.	480	7	1. 395	1. 725
900	2	07	2. 7	2	41	861	427	357.	540	9	1. 626	2. 003
1, 000	2	25	3. 0	3	09	830	363	391. 4	600	11	1. 857	2. 282
1, 100	2	45	3. 4	3	40	799	312	428.	660	14	2. 113	2. 589
1, 200	3	05	3. 7	4	13	771	271	456.	720	18	2. 370	2. 895
1, 300	2	27	4. 1	4	49	744	237	485.	780	22	2. 652	3. 227
1, 400	3	50	4. 5	5	28	718	209	513. 3	840	27	2. 948	3. 575
1, 500	4	14	5. 0	6	10	693	185	539. 7	900	33	3. 257	3. 933
1, 600	4	39	5. 4	6	55	669	165	564.	960	41	3. 579	4. 299
1, 700	5	05	5. 9	7	45	647	147	585. 8	1, 020	50	3. 914	4. 689
1, 800	5	33	6. 4	8	40	625	131	606.	1, 080	59	4. 275	5. 097
1, 900	6	03	6. 9	9	44	605	116	624.	1, 140	68	4. 665	5. 536
2, 000	6	34	7. 4	10	48	585	105	637.	1, 200	78	5. 065	5. 982
2, 100	7	06	7. 9	11	57	566	95	649.	1, 260	89	5. 480	6. 439
2, 200	7	40	8. 4	13	11	547	86	657. 8	1, 320	100	5. 923	6. 921
2, 300	8	16	9. 0	14	30	528	77	663.	1, 380	111	6. 393	7. 428
2, 400	8	53	9. 6	15	53	513	71	664. 8	1, 440	122	6. 877	7. 945
2, 500	9	33	10. 2	17	30	497	64	663.	1, 500	134	7. 403	8. 498
2, 600	10	14	10. 9	19	01	482	58	658.	1, 560	150	7. 944	....
2, 700	10	57	11. 6	20	01	467	54	648. 7	1, 620	172	8. 513	....
2, 800	11	42	12. 3	22	36	453	48	634. 5	1, 680	195	9. 112	....
2, 900	12	29	13. 0	24	32	439	44	615. 8	1, 740	222	9. 741	....
3, 000	13	18	13. 7	26	33	426	40	595. 5	1, 800	249	10. 400	....
3, 100	14	09	14. 5	27	38	413	38	562. 8	1, 860	275	11. 093	....
3, 200	15	02	15. 3	29	42	401	35	528.	1, 920	303	11. 817	....
3, 300	15	57	16. 2	31	45	389	32	487. 3	1, 980	336	12. 575	....
3, 400	16	55	17. 1	34	17	377	29	440.	2, 040	375	13. 382	....
3, 500	17	55	18. 1	36	55	365	27	387.	2, 100	417	14. 226	....
3, 600	18	57	19. 1	39	45	356	24	325. 5	2, 160	460	15. 108	....
3, 700	20	01	20. 1	41	37	346	22	257.	2, 220	506	16. 030	....
3, 800	21	07	21. 2	43	59	336	20	179.	2, 280	555	16. 994	....
3, 900	22	16	22. 3	47	03	326	18	95.	2, 340	610	18. 016	....
4, 000	23	27	23. 5	49	27	317	17	0.	2, 400	665	19. 086	....

*Computed by Lieut. J. R. Selfridge, U. S. N.

† Average height of vessel, 20 feet.

RANGE TABLE.*

Class of gun ....IX-inch smooth-bore.
Charge of powder ....10 pounds, cannon.
Kind of projectile...................Service-shell.
Weight of projectile ....73.5 pounds, filled.
Distance between sights.............. 39 inches.
Initial velocity of shell ....1,320 ft.-sec.

[Ranges referred to horizontal plane through the trunnions.]

Range.	Angle of elevation.	Time of flight.	Angle of fall.	Remaining velocity.	Dangerous zone for vessels.†	Ordinate of the trajectory.	Co-ordinates of the highest point of the trajectory. x	Co-ordinates of the highest point of the trajectory. y	Marks on the sight-bar.
Yards.	° ′	*Seconds.*	° ′	*Foot-secs.*	*Feet.*	*Yards.*	*Yards.*	*Yards.*	*Inches.*
400	0 44	1.0	0 51	1,048	1,200	141.6	240	1.	0.572
500	0 57	1.3	1 09	1,017	1,500	183.4	300	2.	0.740
600	1 11	1.6	1 28	967	1,800	217.6	360	3.	0.919
700	1 27	1.9	1 50	922	625	250.8	420	5.	1.123
800	1 43	2.3	2 14	880	513	314.0	480	6.8	1.327
900	2 00	2.6	2 42	840	425	314.2	540	8.	1.541
1,000	2 19	3.0	3 13	803	356	343.1	600	11.	1.780
1,100	2 39	3.4	3 47	768	296	371.1	660	15.	2.030
1,200	3 00	3.8	4 24	735	260	397.3	720	18.	2.291
1,300	3 23	4.2	5 06	700	224	421.9	780	23.	2.574
1,400	3 47	4.6	5 52	674	195	444.6	840	28.	2.868
1,500	4 13	5.1	6 43	646	167	464.8	900	34.	3.184
1,600	4 40	5.6	7 37	620	149	483.0	960	42.	3.511
1,700	5 09	6.1	8 37	595	131	498.6	1,020	50.	3.858
1,800	5 40	6.6	9 44	571	116	511.6	1,080	60.	4.226
1,900	6 13	7.1	10 17	548	103	521.5	1,140	72.	4.615
2,000	6 48	7.7	12 16	527	92	528.2	1,200	84.	....
2,100	7 26	8.3	13 40	507	82	531.3	1,260	97.	....
2,200	8 06	8.9	15 09	488	73	531.0	1,320	103.	....
2,300	8 48	9.6	16 49	469	65	526.3	1,380	122.	....
2,400	9 32	10.3	18 39	452	58	517.3	1,440	142.	....
2,500	10 19	11.0	20 25	435	53	503.6	1,500	162.	....
2,600	11 09	11.7	21 53	419	49	484.8	1,560	184.	....
2,700	12 02	12.5	24 20	403	44	460.4	1,620	209.	....
2,800	12 57	13.3	26 08	386	41	430.0	1,680	237.	....
2,900	13 55	14.2	29 20	370	36	394.0	1,740	268.	....
3,000	14 57	15.1	31 33	358	32	350.3	1,800	301.	....
3,100	16 01	16.0	34 22	348	29	300.0	1,860	336.	....
3,200	17 08	17.0	37 12	336	26	241.0	1,920	375.	....
3,300	18 18	18.1	40 08	325	23	173.3	1,980	420.	....
3,400	19 33	19.3	43 48	314	21	97.0	2,040	475.	....
3,500	20 59	20.6	48 18	304	18	00.0	2,100	531.	....

*Computed by Lieut. J. R. Selfridge, U. S. N.

†Average height of vessel, 20 feet.

XV-INCH GUN.

Weight of shot ....450 pounds.
Diameter of shot ....14.89 inches.
Kind of powder..........................Mammoth.

Powder-charge.	Initial velocity.	Powder-charge.	Initial velocity.	Powder-charge.	Initial velocity.	Powder-charge.	Initial velocity.	Powder-charge.	Initial velocity.	Powder-charge.	Initial velocity.
Lbs.	*Ft.-secs.*	*Lbs.*	*Ft.-secs.*	*Lbs.*	*Ft.-secs.*	*Lbs.*	*Ft.-secs.*	*Lbs.*	*Ft.-secs.*	*Lbs.*	*Ft.-secs.*
35	931	46	1,087	57	1,199	68	1,294	79	1,381	90	1,458
36	948	47	1,098	58	1,208	69	1,302	80	1,388	91	1,465
37	965	48	1,109	59	1,217	70	1,310	81	1,395	92	1,472
38	981	49	1,120	60	1,226	71	1,318	82	1,402	93	1,479
39	997	50	1,130	61	1,235	72	1,326	83	1,409	94	1,486
40	1,012	51	1,140	62	1,244	73	1,334	84	1,416	95	1,493
41	1,026	52	1,150	63	1,253	74	1,342	85	1,423	96	1,500
42	1,039	53	1,160	64	1,262	75	1,350	86	1,430	97	1,507
43	1,051	54	1,170	65	1,270	76	1,358	87	1,437	98	1,514
44	1,063	55	1,180	66	1,278	77	1,366	88	1,444	99	1,520
45	1,075	56	1,190	67	1,286	78	1,374	89	1,451	100	1,526

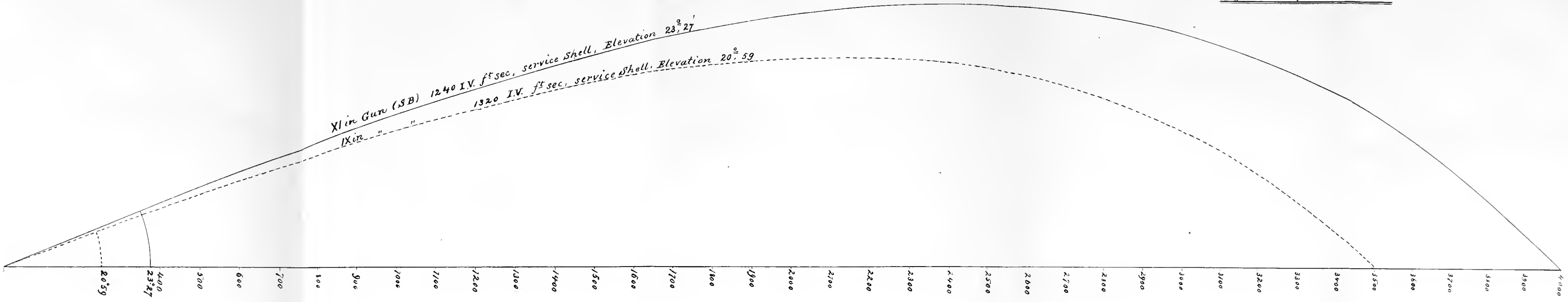
Cubical powder, specific gravity 1.735, and granulation of 74 to the pound, gave in this gun, when fired in a charge of 100 pounds to 450 pounds of shot, a pressure of 25,250 pounds to the square inch and an initial velocity of 1,546 foot-seconds.

Table of elements for various guns of the United States Navy.

Style of gun.	Caliber of gun.	Charge of powder.	Kind of powder.	Weight of projectile.	Initial velocity of projectile.	Weight of the gun.	Weight of the carriage.	Muzzle energy. Total.	Muzzle energy. Per pound of gun.	Muzzle energy. Per pound of powder.	Muzzle energy. Per inch of shot's circumference.	Energy of the gun's recoil.	Energy of recoil of gun and carriage.	Initial velocity of recoil of gun and carriage.
	Inches.	*Pounds.*		*Pounds.*	*Ft.-sec.*	*Pounds.*	*Pounds.*	*Ft.-tons.*	*Ft.-tons.*	*Ft.-tons.*	*Ft.-tons.*	*Ft.-tons.*	*Ft.-tons.*	*Ft.-sec.*
Rifle, muzzle-loading	8	20	Hexagonal	180	1,250	17,000	*3,790	1,952	0.115	97.6	77.7	23.0	18.8	11.4
Rifle, muzzle-loading	8	35	....do	180	1,450	17,000	*3,790	2,627	0.155	75.1	104.5	33.5	27.4	13.8
Smooth-bore, muzzle-loading	xv	100	....do	450	1,600	42,000	*7,350	7,997	0.190	80.0	169.7	105.8	90.0	16.2
Smooth-bore, muzzle-loading	xi	20	Cannon	166	1,062	16,000	*3,790	1,300	0.081	65.0	37.6	15.2	12.3	9.4
Smooth-bore, muzzle-loading	xi	15	....do	136	1,240	16,000	*3,790	1,452	0.091	96.8	42.0	13.7	11.1	9.0
Smooth-bore, muzzle-loading	ix	10	....do	70	1,320	9,000	1,300	847	0.094	84.7	29.9	9.5	6.6	9.6
Rifle (Parrott), muzzle-loading	6.4	10	Rifle	100	1,080	9,700	1,300	810	0.083	81.0	40.6	9.2	8.1	10.3
Rifle (Parrott), muzzle-loading	6.4	8	....do	80	1,140	9,700	1,300	573	0.059	71.7	28.7	6.6	5.8	8.7
Rifle (Parrott), breech-loading	6.4	10	....do	80	1,250	9,700	1,300	868	0.089	86.8	43.5	8.1	7.1	11.9
Rifle (howitzer), breech-loading	3	1	Cannon	7	1,140	500	535	63	0.126	63.1	06.7	1.0	0.5	8.3
Rifle (howitzer), breech-loading	3	$\frac{3}{4}$	....do	7	1,087	350	410	57	0.164	76.5	06.1	1.3	0.6	10.5

* Top-carriage.

Trajectories of IX & XI in Guns



Scale 100 yards to ½ inch

Ordnance allowance of weights going with various naval guns, November, 1878.

	8-inch muzzle-loading rifle.	xi-inch muzzle-loading smooth-bore.	ix-inch muzzle-loading smooth-bore.	80-pounder breech-loading rifle.	60-pounder muzzle-loading rifle.	20-pounder breech-loading rifle (bronze).	3-inch breech-loading howitzer (heavy).	3-inch breech-loading howitzer (light).	12-pounder muzzle-loading smooth-bore howitzer (heavy).	12-pounder muzzle-loading smooth-bore howitzer (light).	Gatling (short).
How mounted	Pivot, cen. comp. iron.	Pivot, cen. comp. iron.	Broadside, M'silly.	Broadside, M'silly.	Pivot, D. bar. iron.	Broadside, D. bar. iron.	Field, iron.	Field, iron.	Field and boat.	Field and boat.	Field with caisson.
Gun	18, 000 lbs.	16, 000 lbs.	9, 500 lbs.	10, 150 lbs.	5, 500 lbs.	1, 339 lbs.	500 lbs.	320 lbs.	750 lbs.	430 lbs.	139 lbs.
Carriage	7, 500 lbs.	7, 500 lbs.	1, 250 lbs.	1, 250 lbs.	1, 949 lbs.	826 lbs.	....	455 lbs.	1, 187 lbs.	654 lbs.	282 lbs.
Shells	20, 230 lbs.	16, 110 lbs.	6, 265 lbs.	8, 000 lbs.	8, 040 lbs.	96 lbs.	....	751 lbs.	....	....	....
Powder	*2, 600 lbs.	2, 805 lbs.	1, 222 lbs.	1, 100 lbs.	1, 124 lbs.	†2, 000 lbs.	....	75 lbs.	....	....	....
Equipments, including tanks	4, 791 lbs.	6, 355 lbs.	1, 372 lbs.	1, 372 lbs.	1, 346 lbs.	826 lbs.	....	287 lbs.	....	....	87 lbs.
Shot, round and long	....	1, 660 lbs.	910 lbs.	....	1, 110 lbs.	....	....	....	....	....	....
Canister and grape	825 lbs.	1, 829 lbs.	720 lbs.	....	....	....	....	....	....	....	....
One set ammunition with equipments	....	....	....	....	....	....	....	....	1, 484 lbs.	1, 410 lbs.	‡2, 750 lbs.
Total weights	53, 946 lbs.	52, 259 lbs.	21, 239 lbs.	21, 872 lbs.	19, 069 lbs	....	....	1, 888 lbs.	3, 421 lbs.	2, 494 lbs.	3, 258 lbs.

* 100 rds. † Saluting. ‡ 25,000 ball-cartridges included.

ORDNANCE OFFICE, NAVY-YARD,
Washington, D. C., June 22, 1878.

SIR: I have the honor to submit the following report of experiments made in obedience to the commandant's order of May 1, 1878, on the subject of firing a line from the 20-pounder breech-loading rifle.

I am, sir, your obedient servant,

W. M. FOLGER,
Lieutenant-Commander, U. S. N.

Lieut. Commander A. S. CROWNINSHIELD,
Inspector of Ordnance.

Approved and respectfully forwarded for the information of the Bureau of Ordnance.

A. S. CROWNINSHIELD,
Lieutenant-Commander and Inspector of Ordnance.

Summary of preliminary experiments made during the months of May and June, 1878, with the 20-pounder breech-loading rifle, to ascertain its capability for throwing a line as a torpedo-drag, and for life-saving purposes.

ORDNANCE OFFICE, NAVY-YARD,
Washington, D. C., June 20, 1878.

PROJECTILE.

The projectile to be used as a grapnel is slightly shorter than the 20-pounder shell, square headed—in order to drive the slack line in the bore clear—provided with the usual leaden band, and having a longitudinal groove in which to lay the line or connecting arrangement, which was secured to the base of the projectile. This groove was cut through the lead band, and the edges of the latter beveled off to counteract the tendency to "fill in" on firing. (Vide Fig. 2*a*.)

The grapnel proper, represented in plate, Figs. 1 and 2, is of wrought iron having four flukes hinged into the end of a bar 15 inches in length and 1 inch in diameter, which is screwed into the solid metal of the head of the projectile. After firing, upon hauling home, these flukes open and cover an area of about 100 square inches. They should fit, when closed, with such friction that a pull of 5 pounds should take them forward in order that they may not be displaced in the bore of the piece.

The base of the shot (hollowed for its reception) was provided with what may be called a "spiral spring swivel." The projectile so fitted, without the grapnel, weighs 20 pounds; provided with the grapnel, 25 pounds.

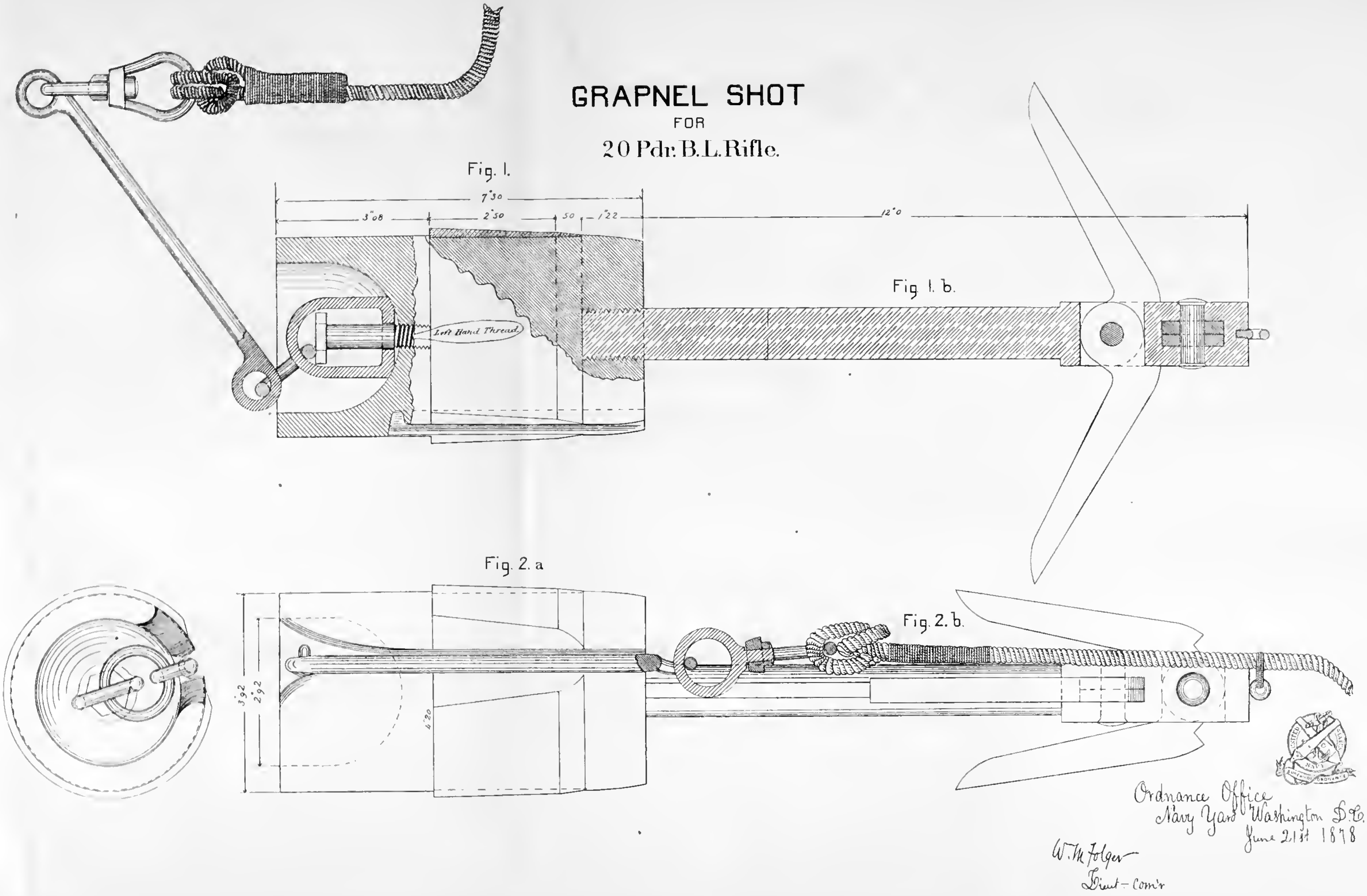
THE CONNECTIONS.

Various contrivances for connecting the line to the shot were proposed and experimented upon as follows, viz:

1. A length of flexible wire rope (tiller-rope), half an inch in diameter, sufficient to reach to the muzzle, was secured to the swivel, using copper wire for the seizing; the latter was increased in strength by filling all parts with solder. Another small wrought-iron swivel was placed at the other or line end in every case.

2. A strand of hide rope, six-tenths of an inch in diameter, was laid up, having increased strength at the short end.

GRAPNEL SHOT
FOR
20 Pdr. B.L. Rifle.

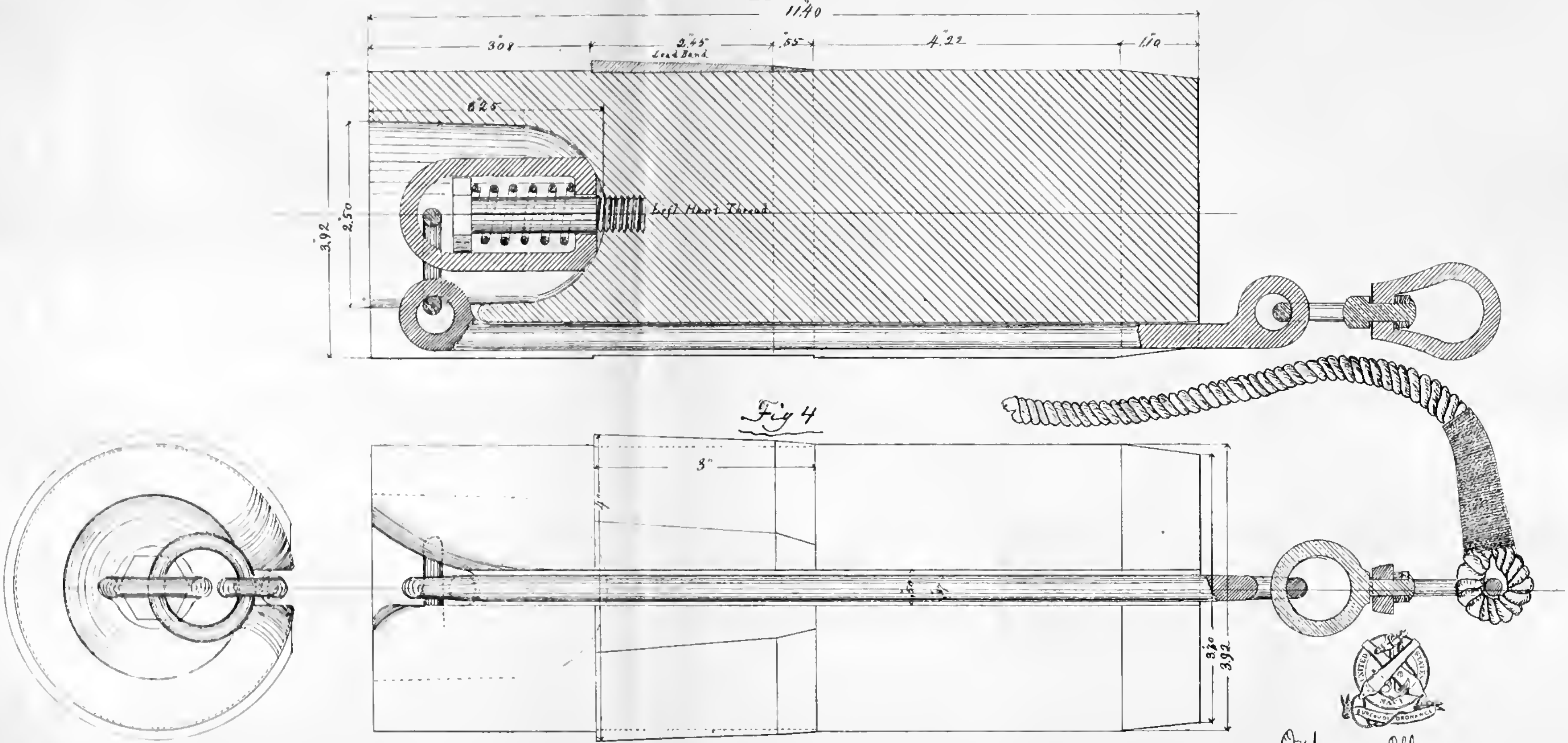


LIFE-SAVING SHOT

for

20 Pdr. B.L. Rifle.

Fig 3



Ordnance Office
Navy Yard Washington D.C.
June 18th 1878

W. M. Folger
Lieut. Com'r

3. A strand of copper wire, six-tenths of an inch in diameter, fitted with a Flemish eye at each end.

4. A number of strands of wire rope, laid up in what is called "selvage fashion," making a diameter of half an inch.

5. The end of the line, strengthened by the addition of strands of linen twine laid about it, was connected directly with the swivel in the base of the projectile.

6. A wrought-iron bar, the length of the shot and twenty-five hundredths of an inch in diameter, was welded into the base shackle.

THE LINE.

The line used was of braided hemp, 1.5 inches in circumference; of a tensile strength of 1,000 pounds; weighing 1.4 ounces per yard. It was borrowed from the Department of Navigation in this yard, and is such as is used in the heading of signals in the United States Navy. The wrought-iron bar and that portion of the line lying in the bore of the gun, when loaded, are wrapped with strips of sheeting until a diameter of half an inch is obtained, and the whole well drenched with water before firing. The line was "French-faked" on the left side of the piece, but it is intended that the English faking-box, at present in use in the Life-Saving Service, be recommended for this purpose.

THE CARTRIDGE.

Lot 2, No. 7 rifle-powder, was used throughout the trials. Various charges were experimented with, weighing from 4 to 8 ounces, with the 20-pound projectile. It was found that a charge one-fortieth of the weight of the shot could be used with safety. For ordinary short ranges, as would probably be desired when using the grapnel, a weight of 5 ounces, or one hundredth, is sufficient. The remaining powder-space was filled with a wooden sabot faced with a wrought-iron plate twenty-five hundredths of an inch in thickness.

Early in the course of the firing it was discovered that, while the 20-pound projectile was well calculated to fulfill all desired ends as a torpedo drag, a greater weight of projectile was necessary to attain results in range that might be favorably compared with those reported by the United States Life-Saving Service; and the shot was lengthened 4 inches, giving a weight of about 32 pounds. (Figs. 3 and 4.)

The result of the trials of the various connections mentioned above, showed that the inertia incident upon the "throwing-back" action, as the shot leaves the muzzle, necessitated great strength and all possible elasticity at this point, the base of the projectile; and the plan marked seven—the wrought-iron bar increased in diameter to thirty-five hundredths of an inch—was definitely adopted as giving the best results. To decrease the inertia, the length of the connecting arrangement was shortened to that of the groove in the projectile.

It will be observed that the left rear end of the groove in the projectile is cut away. This is to allow the bar to drop freely, it being discovered that the wrench incident upon the rotating motion of the projectile causes the bar to strain badly at this point.

TRIAL WITH THE GRAPNEL SHOT OR TORPEDO DRAG.

A short range being desired, but 5 ounces of powder were used.

Number of rounds.	Elevation.	Charge.	Range.
	°	*Ounces.*	*Yards.*
1	20	5	240
2	20	5	230
3	20	5	232
4	20	5	231
5	20	5	235
			5)1168
Mean			233

REMARKS ON FIRING TRIAL.

The flukes fly forward on leaving the gun by the action of the rotation of the projectile, and remain so during its flight. The grapnel shot was also thrown into the river and dragged a number of times up stream and down, into deepening water and the contrary, and the flukes never failed to open in all cases. In placing the projectile in the gun, the line should lie on the right side of the bore, in order to drop clear on leaving the gun.

FIRING TRIAL WITH THE LIFE-SAVING SHOT.

The various trials gave as a safe limit for the weight of the charge thirteen ounces for the line furnished for the experiments. A series of eight shots furnished the following results:

Number of rounds.	Elevation.	Charge.	Range.
	°	*Ounces.*	*Yards.*
1	25	13	420
2	25	13	395
3	25	13	415
4	25	13	420
5	25	13	400
6	25	13	390
7	25	13	415
8	25	13	400
			8)3255
Mean			407

The experiments were discontinued at this point awaiting information in regard to the line used by the United States Life-Saving Service, June 22, 1878. The bureau, upon satisfactory information being obtained, purchased a quantity of line from the Silver Lake Company of Boston, which was experimented with on June 21, 1878. The dimensions are as follows:

Weight per yard	417 grains.
Diameter	0.25 inch.
Tensile strength	640 pounds.

This line proved to be quite stiff, having apparently been dressed with some oily or soap ysubstance in order to eliminate friction. When manufactured for commercial purposes it is used for window-sash cord.

The lack of flexibility caused it to "kink" very badly, and 5 of the 10 shots fired were unsuccessful, the line parting.

Toward the latter part of the trial this difficulty was in a measure obviated, the line becoming softer. The following is the record of the successful shots:

Number of rounds.	Elevation.	Charge.	Range.	Remarks.
	°	*Ounces.*	*Yards.*	
1	25	13	410	Line kinked very badly.
2	25	13	425	Do.
3	25	13	430	Do.
4	25	13	462	Line kinked.
5	25	13	450	Do.
			5)2177	
Mean			435	

This "kinking," doubtless, shortened the range to a considerable extent, and it is respectfully suggested that an attempt be made to remedy the defect by drenching the line in warmed water, and subsequently drying, before further experiments are made.

Respectfully submitted.

W. M. FOLGER,
Lieutenant Commander, U. S. N.

UNITED STATES RECEIVING-SHIP WABASH,
Navy-Yard, Boston, July 23, 1878.

SIR: I respectfully submit the results of the experiments made with the anchor-shot on Saturday, the 20th of this month.

OFF PEDDOCK'S ISLAND, BOSTON HARBOR,
July 20, 1878.

Gun, 32-pounder, 33 cwt. Junk-wad behind shot at each fire. Line used, whale-line, $2\frac{3}{4}$ inch. Elevation of gun, about 12°; wind across line of fire, force from 3 to 4.

Fires.	Weight of powder.	Weight of shot.	Length of line thrown straight.	Slack line.	Total fathoms.	Remarks.
	Lbs. Oz.	*Pounds.*	*Fathoms.*	*Fathoms.*		
1	1	78	94	15	110	
2	1 2	78	112	18	130	
3	1 6	78				Line broke close to shot.
4	1 4	78	127	15	142	
5	1 6	78	137	10	147	
6	1 8	78	150	10	160	
7	1 10	78	160	15	175	
8	1 10	78	157	15	172	
9	1 14	78	157	15	172	

It will be seen from the above table that proportional increased range was not obtained with increased charges of powder, owing to the necessity of using the same line for all the discharges. The line became heavier with water at each fire, and consequently offered greater resistance. With a dry line and a charge of 1 pound 10 ounces of powder, the shot

would carry the line more than 200 fathoms. With a 9-inch gun and a shot weighing 150 pounds, there would be, in my opinion, no difficulty in throwing 400 or more fathoms of 3-inch line, and securely anchoring it to the shore.

So far, the only expense entailed has been $40 for the line; but as I am to be retired from the command of this ship on the 15th of August, I will be unable to furnish shot for more experiments.

As this is a subject that may, when practically demonstrated, cause the saving of many lives, I respectfully urge upon the bureau that the inspector of ordnance at this station may be instructed to make some shot weighing 100 pounds, and continue the experiments. The 400 fathoms of line is as good as when first used by us, and a 100-pound shot fired from the 32-pounder, now mounted on the anchor-hoy, will, I feel confident, carry 300 fathoms of line.

Very respectfully, &c.,

R. CHANDLER,
Captain, Commanding.

Commodore WM. N. JEFFERS, U. S. N.,
Chief of the Bureau of Ordnance, Navy Department,
Washington, D. C.

UNITED STATES NAVY-YARD, BOSTON, MASS.,
Ordnance Office, July 23, 1878.

SIR: In obedience to your orders, I witnessed the experiments with the "Chandler anchor-shot," on the 20th instant, and have to report as follows:

The same gun and line were used as at previous trials. The same style of shot was used, differing only in weight, and also in place of small bolt in head of shot there is a hole bored 1½ inches in depth and diameter, to receive staff, to which the line is secured, to prevent its fouling in the gun. The staff used was 4 feet 6 inches in length, 2 inches diameter.

No. 1 fire.—Weight of shot, 79 pounds; charge, 1 pound; elevation, 26°; 94 fathoms line thrown out; shot fell about 3 fathoms short of beach.

No. 2 fire.—Charge, 1 pound 2 ounces; 112 fathoms line thrown out; shot struck just at water's edge on beach.

No. 3 fire.—Charge, 1 pound 6 ounces; wire pennant parted; found shot about 700 yards from gun.

No. 4 fire.—Charge, 1 pound 4 ounces; shot struck at water's edge; run out 127 fathoms line.

No. 5 fire.—Charge, 1 pound 6 ounces; shot struck at water's edge; 140 fathoms line out.

No. 6 fire.—Charge, 1 pound 8 ounces; shot struck at water's edge; 150 fathoms line out.

No. 7 fire.—Charge, 1 pound 10 ounces; shot landed on beach; lower arm closed; when hauled on, shot was dragged home; 160 fathoms line out.

No. 8 shot.—Charge 1 pound 10 ounces; whale-line made fast to shot; served over with wet serving for 4 feet from base of shot; 160 fathoms line thrown out.

No. 9 fire.—Charge, 1 pound 14 ounces; line made fast directly to shot as in No. 8; 160 fathoms line thrown out; force of wind varied from 2 to 4 during firing; wind diagonally across line of fire and off shore.

Very respectfully,

GEO. F. F. WILDE,
Lieutenant-Commander, U. S. N.

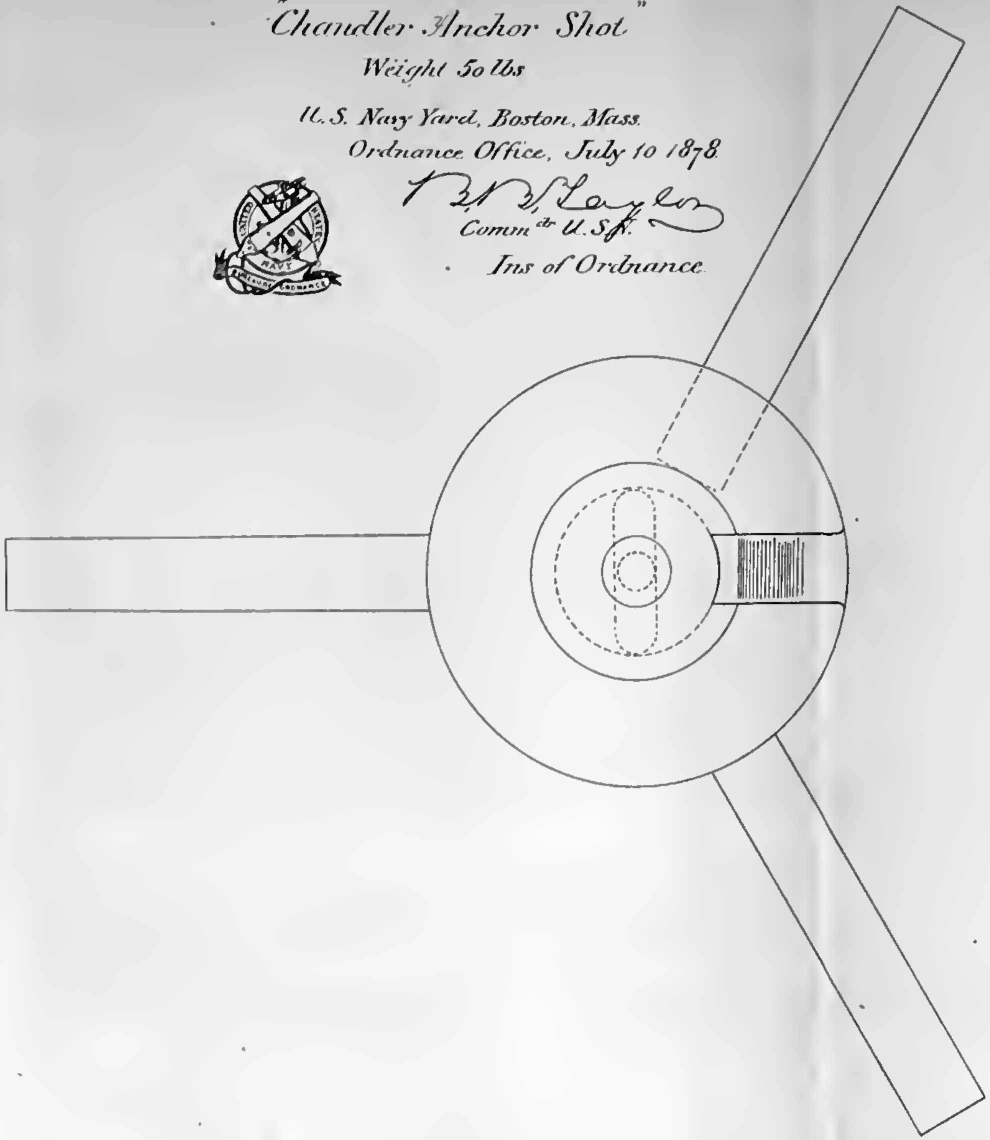
Commander B. B. TAYLOR, U. S. N.,
Inspector Ordnance.

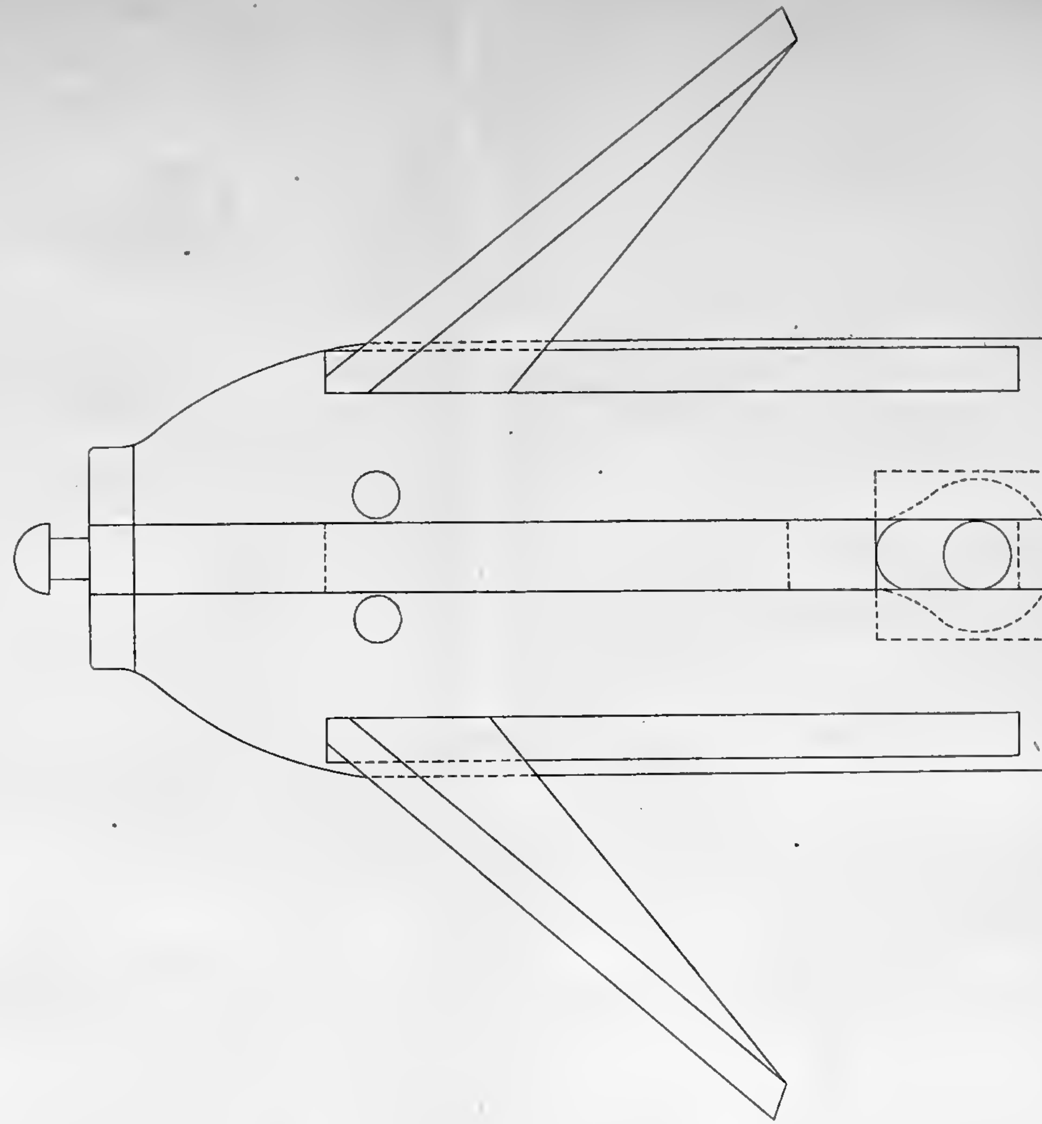
"Chandler Anchor Shot"

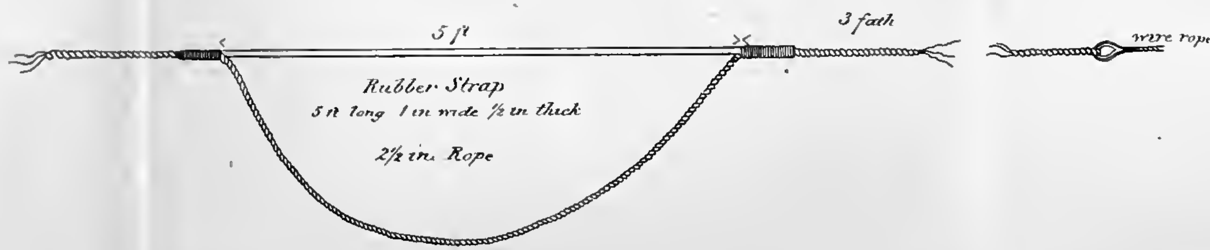
Weight 50 lbs

U. S. Navy Yard, Boston, Mass.
Ordnance Office, July 10 1878.

Comm^dr U.S.N.
Ins of Ordnance







ORDNANCE OFFICE,
Navy-Yard, Washington, D. C., June 28, 1878.

SIR: In obedience to your order of May 29, 1878, we have to make the following description, as well as report of the trial, of the Bailey machine-gun. The gun was presented on the 19th instant at this department.

DESCRIPTION.

The Bailey gun has but one barrel of one-inch caliber, mounted on the ordinary small Gatling carriage. The mechanism for operating the gun is immediately in rear of the barrel, and is arranged in an iron and bronze frame, and is quite compact. The accompanying drawing gives sectional views of the gun and mechanism.

The *carrier* or tray A, immediately in rear of the barrel, is given a lateral motion by a lever operated by two cams on the wheel B. The cartridges fall into the *carrier* or tray, and are transferred in succession before the *lock* C, by which they are forced into the chamber, fired, and the empty shell extracted. The *lock*, working in suitable guides, is fitted with a ratchet on its lower side, into which works a cogged portion of the wheel B. It is seen that a partial revolution of this wheel will give the lock either a forward or backward movement, accordingly to its direction. The wheel B is worked by a crank on the right side of the piece; but from the nature of the mechanism it does not have an all-round motion; it being necessary to first give it a partial revolution (to the right) by which the lock is run forward, then a reverse motion which draws back the lock.

The block D, moving in guides, has a perpendicular motion which is given it by another cogged portion of the wheel B working into a ratchet on its right side. The lock in its forward and backward movements passes over this block. The moment the rear end of the lock, in its forward movement, has passed the block D, the latter moves up behind the lock; its object being to support and receive the thrust due to the shock of the discharge.

The firing-pin E is drawn back by the shoulder *e* catching over the *dog* or small piece of steel *f* as the lock moves forward, thus retaining the firing-pin and compressing the spiral spring *g*. The pin is released by a small projection, *h*, on the block D, which, by the upward motion of the latter, forces up the dog *f*, the pin flying forward and exploding the cartridge.

A short spring-extractor on the forward end of the lock withdraws the empty shell, which drops by gravity through the open space provided for that purpose.

The operation of the mechanism is as follows:

A cartridge falls through the feeding-port in the top of the piece into the tray or carrier; the crank is given a partial revolution from left to right; at the beginning of this movement one of the cams on the wheel B immediately operates to move the tray with its carriage in front of the lock; the latter then receives its forward movement, forcing the cartridge into the barrel; the block D rises the moment the rear end of the lock has passed it, the small projection *h* releasing the firing-pin at the moment the block reaches its extreme upward movement, when it is also in position to support the lock. The tray is moved back to its original position by a second cam on the wheel B; this movement occurs when the cartridge is nearly entered into the barrel. A reverse movement of the crank moves the lock to the rear, extracting the empty

shell, and making way for the tray to bring another cartridge into place for loading.

The ammunition presented by Mr. Bailey was fixed, brass case; lead bullet, 2″.03 long and 1″.007 diameter, weighing 4,903 grains; charge, 472.4 grains.

Ammunition was also presented for trial with a shorter bullet, .818″ in length, between which and the powder were 15 spherical lead balls of .455″ diameter, each weighing 141 grains.

Total length of cartridge, 4″.75; diameter of cartridge near butt, 1″.08.

The gun and carriage were weighed separately:

	Pounds.
Weight of gun (barrel alone 24 pounds 2 ounces 26 grains)	86
Weight of carriage	263
Total	349

TRIAL, JUNE 20, 1878.

The piece was first aimed at the 1,300-yard target. Four shots were fired to get the range (the gun not being sighted or ranged), which was readily obtained, an observer being stationed near the target to signal results.

The inventor was then requested to fire 100 shots as rapidly as possible at the 1,300-yard target. The firing began, Mr. Bailey at the crank, but was brought to a sudden close at the fourth shot by the breaking short off of that portion of the mounting called the foot of the saddle. It was of cast iron, and, though T-iron, quite small.

The following points were observed during the limited firing done before the board:

There was a great deal of spring in the carriage, the muzzle of the piece moving in an arc of nearly 3 inches.

The recoil was several inches, destroying aim at each discharge.

The crank appeared to need much forcing on one occasion.

The support of the elevating-screw having given way in the first trial by excessive recoil of the piece, the carriage was repaired for a second trial by bolting a heavy piece of oak under and along the trail, extending a foot on either side of the screw support; the latter was mortised into the oak block to give better security. This oak block extended to the ground, and was of sufficient length to entirely support the trail. Its weight was 92 pounds.

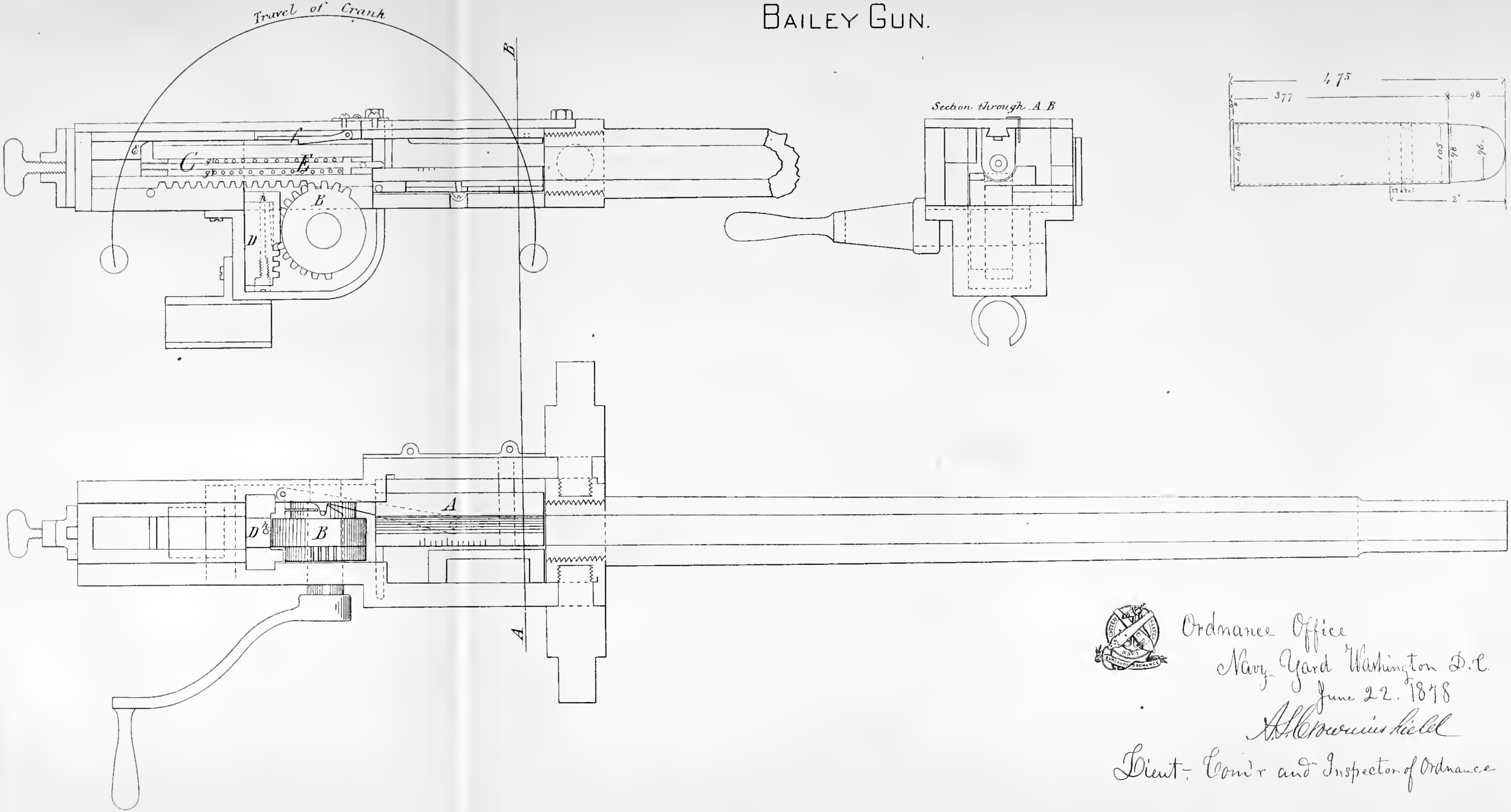
The mounting having been repaired, the trial was proceeded with on June 22, 1878.

The inventor was requested to fire 10 shots for "rapidity of fire" at the 1,300-yard target. After two or three preliminary shots to obtain the range, the inventor, working the piece himself, commenced firing. Time for 8 shots, 31 seconds. At the 8th shot the mechanism became completely locked, necessitating a delay of 9 minutes to clear it. It appeared that a shell had jammed in the barrel so tightly that the lock could not be withdrawn. It was rammed out from forward.

The recoil amounted to 2 or 3 inches at each discharge. The accuracy was very bad, the last shots of this series falling at least 50 or 60 yards to the left and beyond the target.

The inventor was requested to fire 12 shots for rapidity of fire. Time to fire 11 shots, 30 seconds. It was observed that the crank worked with great difficulty, Mr. Bailey being obliged to use much force to make it move through the 180° necessary. This effort threw the piece completely off the line of fire, when the board considered it necessary to ask Mr.

BAILEY GUN.



Ordnance Office
Navy Yard Washington D.C.
June 22. 1878
A. S. Crowninshield
Lieut. Com'r and Inspector of Ordnance

Bailey to discontinue, as projectiles were passing in dangerous proximity to Poplar Point.

TRIAL, JUNE 26, 1878.

The firing began, Mr. Bailey at the crank, the cartridges being fed by hand. Two shots were fired, for range, at the 1,300-yard target. The inventor was then requested to fire 12 shots, but at the 11th round firing was stopped on account of the projectiles striking to the left. Time, 56 seconds.

A second series of 12 shots fired; time, 32.4 seconds. At the end of this series the barrel was so hot as to burn the hand. Thirty-five shots were then fired for rapidity of fire; time, 1 minute. The gun was then carried to the edge of the sea-wall, and depressed at an angle of 22°; depression being chiefly obtained by blocking up the trail, the guide of the elevating-screw not being long enough for natural depression. Twelve shots were fired in 19.8 seconds, the recoil being so violent as to lift the carriage bodily about 2 inches.

The fact that this gun recoils at each shot, and consequently disturbs the sight, is sufficient to destroy its efficacy as a machine-gun; for the object of a machine-gun, *i. e.*, rapidity of fire, is really lost. This point might be corrected by increasing the weight of the frame, carriage, or barrel. Whatever way it is done, it is a *sine qua non* that the piece does not move sufficiently to destroy the aim.

The loading and extracting were not done with desirable certainty, as the record shows.

We do not think the ammunition of a desirable kind, as the lead projectile, weighing half a pound, is of too large a caliber to answer the purposes of a machine-gun, and too small for a repeating cannon, which should be able to fire shell as well as other ammunition.

The feed and extractor require perfecting, and the reversing of the crank, necessary from the nature of the mechanism, we consider very awkward—a motion that interferes very greatly with rapidity of fire.

A paper presented by Mr. Bailey, on the object, resources, &c., of his gun, is appended to this report for the information of the Bureau of Ordnance.

We are, sir, your obedient servants,

A. S. CROWNINSHIELD,
Lieutenant-Commander, U. S. N.
YATES STIRLING,
Lieutenant-Commander, U. S. N.
W. M. FOLGER,
Lieutenant-Commander, U. S. N.

Commodore JNO. C. FEBIGER,
Commandant Navy-Yard, Washington.

To ——— ———.

WASHINGTON, D. C., *June* 16, 1878.

SIR: In compliance with the rules of the Bureau of Ordnance, dated Washington, February 20, 1875, I herewith submit a statement showing the claims and object of the Bailey single-barrel cannon.

FORTUNE L. BAILEY, *Inventor.*

First. The object of the invention is to furnish a light, serviceable cannon, of any desired caliber, capable of throwing shot, canister, or shell, and so arranged in its mechanism as to be automatic in its operation, and susceptible of being loaded and fired in rapid succession, combining strength of parts and simplicity of construction.

Second. Its lightness of weight, economy of cost, adaptability for great depression, and accuracy of fire at a range of from 2,000 to 4,000 yards, according to the size, its capability of throwing a small iron projectile a short or great distance with sufficient force to penetrate the iron of the strongest torpedo-boats, requiring not more than two men to handle it, render the same the most effective gun for quick naval action and for all branches of Army service.

Third. The invention is entirely new, and its novelty consists in rapid loading, firing, and discharging the empty cases, and its application to purposes hereinbefore mentioned.

Fourth. The application for a patent is now pending.

UNITED STATES TORPEDO STATION,
Newport, R. I., January 10, 1878.

COMMODORE: I have to inclose copy of a letter addressed by me to Commander Howell, marked A; copy of letter from him in reply, marked B; also order to a board of officers to witness the experiments under the direction of Commander Howell, and the report of the board; also an account of a few experiments had since.

It would seem that the diving apparatus of the torpedo is at fault, or that the exterior surface of the exit-pipe is not parallel to the longitudinal axis of the torpedo, or that the torpedo contains in itself the cause of the trouble found in its not preserving a constant depth.

To ascertain definitely the cause or causes of this defect by a series of experiments and alterations on the present torpedo would be very costly, and I do not think that if that difficulty should be overcome that this torpedo would then be a success; certainly Commander Howell can, at great less cost, by an entirely new design, much better illustrate his principles, and, possibly, give an effective torpedo.

As there is no draughtsman at the station I would respectfully ask permission to photograph the torpedo as one of the most ingenious inventions of the day, and as possessing a principle which some day may come in use.

Respectfully, your obedient servant,

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance, Washington, D. C.

A.

UNITED STATES TORPEDO STATION,
Newport, R. I., December 26, 1877.

SIR: Commander Selfridge, Lieutenant Maynard, and Lieutenant Couden are appointed a board to witness and report on the trials of your torpedo, under your direct arrangement.

I desire that you will submit to me a general description of your torpedo and its merits as claimed by you, and that you will state what, if any, mechanical defects there may exist in its present condition.

Respectfully,

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in charge of Station.

Commander J. A. HOWELL, U. S. N.

B.

UNITED STATES TORPEDO STATION,
Newport, R. I., December 26, 1877.

SIR: In reply to your order of this date to submit a general description of my torpedo and its merits as claimed by me, and to state any mechanical defects that may exist in its present condition, I respectfully state:

My torpedo consists in a shell of copper having the shape of a cylinder, terminated by cones. Its displacement is about 270 pounds. Light brass rings within, to which cylinder and cones are screwed, serve to bind the whole together. The rings also support a rectangular framework of steel, in which two fly-wheels are carried so as to revolve freely on their axles, which are parallel and pass through the longitudinal axis of shell and perpendicular to it. Small pulleys on the axles are connected by belts, and one pulley is connected with a larger pulley of a centrifugal pump, the exit-pipe of which passes aft with its axis also in the longitudinal axis of shell. A driving-rudder of the usual construction is attached, as is also a vertical rudder.

My topedo is constructed with the intention of making use of the following principle: "A body revolving about an axis, when solicited to move about another axis, will revolve about an intermediate axis."

I make use of this principle by giving the fly-wheels great angular velocity, their planes being vertical, or axles horizontal, and then dropping the torpedo in the water.

When launched from the broadside in this way from a ship at sea, rolling and pitching and moving at full speed, it may be considered certain that the torpedo would be subject to forces that, without a revolving fly-wheel, would make its course through the water perfectly uncertain, and most likely dangerous to the ship from which it is launched.

I claim that the fly-wheels will change the axis of rotation of the torpedo (whatever may be the axis about which the deviating force may tend to cause it to revolve); also that the resulting angular deflection will be very much reduced, and that the torpedo can afterward be brought back to its original condition by an automatic corrector. I claim that by the revolving fly-wheels a deviating force (which would be sufficient to turn the torpedo so much that it would be dangerous and perfectly unreliable without the revolving wheels) will produce no appreciable angular motion in the torpedo.

I claim a force to deviate or give motion to the torpedo about its vertical axis, supposing its axle and the axles of the fly-wheels horizontal, will cause a much less angular motion about the longitudinal axis.

As the torpedo rolls, a pendulum puts a friction wheel in action; this by a tiller-rope acts on the vertical rudder, which, being put so as to exert an opposite deviating force, rolls the torpedo back. I therefore claim for my method that I allow for a deviating force and only very much diminish the angular motion of the torpedo, resulting from it. That by obtaining a resulting roll for the action of a deflecting force, I am, by means of the pendulum, enabled to apply an equal opposite deflecting force to the torpedo. . Or, in other words, I am by the above methods enabled to allow and counteract any deviating force; and it is a deviating force, by which I mean a force tending to alter the compass-heading of the torpedo, that we must expect to meet with in launching torpedoes from ships at sea. A rolling force will produce deviation, but, neglecting the rolling forces from the propeller for a moment, I claim that such roll-

ing force, since it appears as deviating angular motion, may be neglected.

I claim no particular merit in the diving apparatus or the propeller. The latter has only been devised as offering the best probability of giving no rolling reactions.

Though I drive the propeller from the fly-wheels, I claim my invention to have for its object more particularly the *guiding* of torpedoes, although I *believe* that the fly-wheel will be the best and cheapest method of driving these broadside torpedoes, which being used at vessels rapidly crossing the line of torpedo direction, need not range over one hundred yards. I find the torpedo constructed so that it is in entire accordance with my plans; any defect it may have is due to the plan. The pendulum and steering apparatus may not be sufficiently delicate, but I think the idea can be carried out. The pendulum now does the work. A more delicate way would be to have the pendulum simply establish a circuit; the magnets then press up the friction-wheel.

Very respectfully,

J. A. HOWELL,
Commander, United States Navy.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, Commanding Station.

UNITED STATES TORPEDO STATION,
Newport, R. I., December 26, 1877.

SIR: You are hereby appointed a board to witness the trials of Commander Howell's torpedo as conducted by him and to report them in detail, with such remarks as may seem necessary to you to show perfectly the designs of the inventor. I call your attention to the inclosed general description of the torpedo embracing its merits.

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in charge of Station.

Commander F. O. SELFRIDGE, U. S. N.; Lieut. W. MAYNARD, U. S. N.; Lieut. A. R. COUDEN, U. S. N.

UNITED STATES TORPEDO STATION,
Newport, R. I., January 5, 1878.

SIR: In obedience to your orders, we have witnessed the various trials of the Howell torpedo, conducted by Commander Howell in person, and report in detail, as follows:

DECEMBER 27.

During forenoon, engaged in ballasting the torpedo and in testing the detaching apparatus by dropping the torpedo when running at moderate speed. The torpedo was ballasted so that it floated with its longitudinal axis horizontal and with its upper surface about $1\frac{1}{2}$ inches out of the water. The detaching apparatus worked satisfactorily.

It was observed that the torpedo required more power, as applied by the hand to the bow, to deflect it horizontally when the fly-wheels were in motion than when they were at rest, the torpedo being in water. The above trials were made in a small tank.

In afternoon made trials from the Nina. Calm; no sea; no current. The frame from which the torpedo is dropped was secured to the port

side of Nina abreast the foremast, the outer end hung from the fore-gaff, and the inner corners were movable on two vertical iron bars secured to the guard-rail of Nina.

1st trial.—34 pounds steam. Steam on torpedo, 1^m. Torpedo dropped from about $3\frac{1}{2}$ feet above water. When dropped, the torpedo disappeared for about 10 seconds; then rose to the surface about 10 feet from frame-work, remained at surface, kept a straight course for about 40 feet, after which she gradually turned to port, and at 100 feet had turned through 180°, when the engines stopped. Speed of engine estimated at 2,000 revolutions per minute when torpedo was dropped. Time occupied in running 100 feet, $1^m\ 6^s$.

2d trial.—36 pounds steam. Steam on torpedo, 1^m. Torpedo dropped about $3\frac{1}{2}$ feet, disappeared below the surface, and after running 25 feet rose to surface bow first, ran 25 feet at surface, then dived to bottom and stuck in the mud. The entire 50 feet was in a straight course. Speed considerably greater than before; probably not more than twice as great. On raising torpedo found about one quart of water in her. Clutch-valve leaks.

3d trial.—40 pounds steam. Steam on torpedo, $1^m\ 23^s$. Lowered frame, torpedo dropped $1\frac{1}{2}$ feet, rose to surface bow first at about 15 feet from frame, turned to level, then bow rose into the air, then she turned and dived vertically to the bottom. Total distance run, over 50 feet; course, straight; time, 17^s. Leaked, as before, to about the same quantity.

4th trial.—Steam 40 pounds. Steam on torpedo, $1^m\ 20^s$. Torpedo dropped $1\frac{1}{2}$ feet and did not rise again to the surface. Total distance, about 15 feet. The engine of torpedo worked $2^m\ 6^s$. When raised, the torpedo contained about the same quantity of water.

DECEMBER 28.

Occupied in repairs to leaky case. Added about $3\frac{1}{2}$ pounds of ballast; shifted ballast aft and downward. Reduced surface of diving-rudder one-half. Stiffened springs of clutch-valve.

DECEMBER 29.

Resumed trials from Nina. Calm; no sea; no current; 40 pounds steam.

1st trial.—Steam on torpedo $1^m\ 35^s$. Torpedo dropped $1\frac{1}{2}$ feet, rose to surface about 30 feet from frame, kept a course at surface for 20 feet, then dived vertically to bottom. The 50 feet was in a straight course.

2d trial.—Steam on $1^m\ 35^s$. Torpedo rose to surface at about 60 feet from frame, came to surface at a very small angle, ran 15 feet at surface, and dived, as before, 75 feet; distance occupied 24^s.

3d trial.—Diving-rudder lashed in a horizontal position; torpedo stuck in the mud a short distance from frame.

4th trial.—Diving-rudder lashed so as to bring the torpedo to the surface. Torpedo rose to surface just clear of frame, then ran with her bow about 4 inches out of water, maintaining a straight course for about 70 feet, then turned gradually to starboard; whole distance run, about 120 feet. Speed same as in previous trials. Speed of engine was taken just before dropping torpedo, 2,400 revolutions per minute.

DECEMBER 31.

Torpedo in tank. Fly-wheels of torpedo not in motion; two weights, 5 pounds each, hung so as to pull horizontally as a couple at the bow and stern; deflected torpedo 30° in $1\frac{1}{2}$ and $1\frac{1}{4}$ seconds.

Under the same circumstances, except that the fly-wheels of torpedo

were making 1,476 revolutions per minute, the same deflection was produced in 2 seconds.

When torpedo fly-wheels were not in motion, a slight pressure of the hand on bow or stern was sufficient to give it a rapid motion in azimuth, the torpedo turning readily about a vertical axis; when torpedo fly-wheels were in motion the same pressure applied to the bow produced very slight change in azimuth, but the torpedo moved bodily to the right or left, maintaining nearly the same compass course; at the same time the torpedo rolled slightly in the opposite direction. If one end of the torpedo was held fast, a considerable pressure was necessary at the other end to deflect the torpedo, and any deflection was accompanied by a rolling motion in the opposite direction.

JANUARY 2.

The following changes have been made: Two vertical wooden pieces have been secured to the bow; two similar pieces horizontally on the stern. These pieces of pine, 1½ inches thick, reach the entire length of the bow and stern cones, and are prolongations of the cylindrical portion of the case. A strip of lead, 1½ inches wide, extending the whole length of the cylinder, has been secured to the bottom of the cylinder outside; weight, 7 pounds. A bellows has been placed in the bow cone of the same area as the old bellows; the use of the old bellows is discontinued; the new bellows is connected to diving-rudder by a wire on outside of case. The torpedo floats practically the same as heretofore.

Resumed trials from Nina. Wind moderate, 4 points on port bow of torpedo; smooth sea; no current; 40 pounds steam.

1*st trial.*—Steam on torpedo, 1^{m} 15^{s}. Torpedo rose to surface at about 30 feet from frame in a straight course, remaining at surface, she expended her force in a spiral with decreasing radius, turning to port. The torpedo turned or rolled about its longer axis until the wooden dieces were forward nearly horizontal; that is, nearly 90°. This turning on the torpedo's axis brought the steering-rudder into action, and, when the torpedo was recovered, the steering-rudder was found hard a-port. Under the circumstances, the torpedo having turned on to its side, the steering-rudder had little tendency to correct her course, but became a diving-rudder, while the diving-rudder became a steering-rudder, and turned the torpedo to port.

After this trial, removed wooden pieces, outside ballast, and 4½ pounds of lead from inside. Torpedo now floated practically as heretofore.

2*d trial.*—This trial made at less than usual speed of engines. Torpedo rose to surface, and dived three times in a straight course of 75 feet, rose and dove at a sharp angle with the vertical, diving to bottom at last. Speed about the same as heretofore.

3*d trial.*—Whole distance run about 25 feet, where torpedo dived to the bottom.

4*th trial.*—Secured diving-rudder so that it did not have so much play in a direction to make her rise. She ran a straight course for about 60 feet at about 3 feet below surface, then rose to surface nearly level, returned to 3 feet below surface, ran about 10 feet, and dived to bottom. Speed about the same as heretofore.

5*th trial.*—Secured diving-rudder so that it had little play in either direction. Torpedo rose to the surface at 10 feet and at 20 feet dived to the bottom.

6*th trial.*—Cut off forward portion of balanced diving-rudder. Torpedo dived to the bottom at 25 feet.

7*th trial.*—Trial at slow speed of engines. Torpedo dived to the bottom at 15 feet.

In conclusion, referring to the letter of Commander Howell, accompanying this report, describing his torpedo, he lays down its principle as follows: "My torpedo is constructed with the intention of making use of the following principles: 'A body revolving about an axis when solicited to move about another axis will revolve around an intermediate axis.'" We find in the tank-trials, with the fly-wheels in revolution, that when a force was applied to one end of the torpedo, the result was to cause the torpedo to move sideways bodily, preserving a direction almost parallel to its direction before the force was applied, and also to cause it to revolve slightly about its longitudinal axis, which is in accordance with the above principles. This rolling motion brings the steering rudder into action.

The trials from the Nina were under circumstances (smooth sea, calms, and light winds, and no currents) very favorable to its working, and not calculated to bring out the principle of the torpedo as claimed by Commander Howell; the diving apparatus was so defective as to prevent the torpedo from exhibiting to the board what the trials in the tank would have led them to expect if the torpedo could have been kept for any distance in a horizontal position.

Very respectfully, your obedient servants,

THOS. O. SELFRIDGE, JR.,
Commander, U. S. N.
W. MAYNARD,
Lieutenant, and Assistant Inspector of Ordnance.
A. R. COUDEN,
Lieutenant, and Assistant Inspector of Ordnance.

Experiments with Howell's torpedo from United States ship Nina, after trials in presence of the board.

JANUARY 8, 1877.

Since last trial soldered a small copper lip to lower half of outer end of exit-pipe, lip inclined upward so as to throw the discharge-stream up. Removed 8 pounds 10 ounces of lead from inside of bow-cone. Diving-rudder set for diving at an angle of about 8°.

1st trial.—Steam 40 pounds. Steam on engine, 1^{m}. Frame just clear of water. The torpedo came to the surface about 3 feet clear of frame, and ran at the surface, end of bow-cone just out of water, in nearly a straight course for about 75 feet. Then it gradually rolled to port and turned to starboard, the diving-rudder steering it around. Total distance run about 120 feet. Diving-rudder seemed to have no tendency to make torpedo dive.

2d trial.—Set diving-rudder for diving at an angle of about 15°. Steam, 40 pounds. Steam on engine, 1^{m}. The torpedo ran about the same distance and in the same manner as in the 1st trial, except that after coming to the surface it kept nearly on an even keel longitudinally. Ran $1\frac{3}{4}^{m}$.

3d trial.—Returned 6 pounds lead to bow-cone. Steam, 34 pounds. Steam on engine, $1^{m}\ 10^{s}$. Torpedo came to the surface about 5 feet from frame, ran at surface (torpedo horizontal) in nearly a straight course for about 60 feet, then rolled slowly to port and turned to starboard, striking breakwater. Time of running, 1^{m}.

4th trial.—Lashed a strip of lead weighing 5 pounds 8 ounces along the bottom of the cylindrical part of torpedo, trimming torpedo considerably

by the stern, and rendering it just buoyant enough to float. Steam, 40 pounds. Steam on engine, 1m 22s. Torpedo rose to surface 6 feet from frame, and ran in nearly a straight course for about 40 feet, then rolled to port as before, turned the starboard, and ran into the breakwater.

5th trial.—Took off the lip on under side of outer end of exit-pipe. Steam, 40 pounds. Steam on engine, 1m 20s. Torpedo came to the surface 8 feet from frame, nearly vertical. Ran *very slowly* in this position for about 20 feet, rolled slowly to port, and turned to starboard.

6th trial.—Steam, 40 pounds. Steam on engine, 1m 35s. Torpedo rose 10 feet from frame, nearly vertical, turned slowly about horizontal axis, and dove to the bottom at 40 feet from frame, sticking fast in the mud.

A.

TORPEDO STATION, *March* 12, 1878.

SIR: In accordance with your direction, I respectfully submit the following report in relation to some experiments with certain fuses in dynamite. These were part of those which I have been making the past few months on frozen dynamite.

The fuses used were of two kinds. One was a fuse made by Mr. J. H. Striedinger, of New York; the other was the detonating fuse made at this station.

The construction of Mr. Striedinger's fuse is as follows:

The bared ends of two pieces of insulated wire are fixed in a small copper cylinder by sulphur and connected across by a bridge of fine wire; another short copper cylinder fits into the first, inclosing the bridge, and is filled with a priming powder retained in place by a rubber-cloth disk; a copper shell contains the charge (about 20 grains of fulminate), and into this shell fits the other part; the whole is dipped in some black varnish.

The resistance of these fuses averages about 1.75 ohms each (cold).

Mr. Striedinger claimed for these fuses that they would infallibly explode nitro-glycerine and its preparations when frozen. Our experience with frozen dynamite had been that there was a considerable degree of uncertainty about its explosion with a single fulminate fuse.

Thus, in a series of experiments made at this station in winter of 1876–'77, it was found that the simple fulminate fuse (detonator) nearly always failed to explode frozen dynamite, in large and small charges. (Secretary of the Navy's Report for 1877.) In many previous experiments, explosion by the same fuse was usually obtained, but also with many instances of failure.

The same station fuse has been used in the recent experiments as in those of a year ago and at earlier times, viz: a platinum wire fuse, primed with gun-cotton and containing 20 grains of pure fulminating mercury.

Of 18 of Mr. Striedinger's fuses, 17 exploded their charges of frozen dynamite and one failed to do so, although the explosion of the fuse tore to pieces the can, scattering the dynamite, and was sharp enough to be noticed although in a considerable depth of water.

Of 30 station fuses fired in similar charges, 28 exploded their dynamite and 2 did not, although exploding themselves with force enough to burst the cans in which they were placed.

The general result thus indicated is very different from that obtained a year ago. Then explosion was obtained but rarely, while at this time

there were but 2 failures in using 30 of the station fuses, and but 3 in 48 trials, including the 18 Striedinger fuses.

Still, it remains that the explosion of frozen dynamite does not *always* occur with a simple fulminate fuse. At some times and under certain circumstances it is nearly always accomplished, and at others the reverse is true. The cause for the non-sensitiveness of a frozen dynamite is to be found, I think, principally in the nitro-glycerine of which it is made, and also in its mechanical condition. I have found that nitro-glycerines (that is, different lots) do vary in sensitiveness, and necessarily the dynamites made from them will correspondingly vary. But I shall recur to this point in my fuller report on experiments with dynamite, and therefore will not discuss it here.

Comparing Striedinger's fuse with ours, the only essential difference between them is in the priming, his having a priming-powder, and the station gun-cotton. It is not easy to see why this should make any difference in their performance. The fulminate in both is pure and nearly the same in amount. Mr. Striedinger's fuse is a good one, but possesses no superiority over others of the same type.

As already stated, 1 in 18 of the Striedinger fuses failed to explode frozen dynamite. Perhaps the proportion would have been different if more experiments had been made, but there were but 25 of the fuses originally. I regret that there were not more of them and opportunity for more numerous trials, but if the experience of a year ago had been repeated, the number employed would have been sufficient.

In continuing these experiments in the future I should wish to try Mr. Striedinger's fuses again, and would request that 200 or 300 be purchased.

However, one failure to fire is sufficient to indicate an uncertainty, unless it appears that the fuse is defective, which certainly could not be said of any of Mr. Striedinger's fuses.

As already stated, 2 in 30 (or 1 in 15) of the station-fuses failed to fire the frozen dynamite. This result is quite different from that of a year ago, but the two failures show that the uncertainty does exist.

It is plain that the performance of the Striedinger fuse in frozen dynamite is practically the same as that of the station fuse, as might be expected. At this time, each nearly always exploded it. At another time, and under other circumstances, the reverse might occur, as in the trials of a year ago.

I must not omit to note one point of difference between this and the previous time.

During the winter of 1876–'77 we had much cold weather. Nitro-glycerine and dynamite in magazine froze early, and remained frozen nearly all winter; while during the months just past we have had but very little really cold weather; nitro-glycerine and dynamite hardly froze at all in the magazines, and but comparatively lightly; and even if freely exposed, there have been this last winter but few days when dynamite would freeze hard and quickly, so that to make sure of freezing I have placed the cans into which the dynamite was charged in ice.

Finally, I would remark that a charge of frozen dynamite fixed by a Striedinger fuse gave very nearly the same figure in the force-measuring apparatus as a similar charge fired by a station fuse.

Very respectfully,

WALTER N. HILL.

Capt. K. R. BREESE, U. S. N.

B.

TORPEDO STATION, *March* 12, 1878.

SIR: I respectfully present the following account of some experiments with frozen dynamite:

A year ago in a series of experiments it was found that explosion of frozen dynamite was rarely obtained when a simple fulminate fuse was used. In previous trials it had been found that explosion usually occurred, but with not infrequent instances of failure, and that firing seemed to be largely dependent on the mechanical condition of the explosive, that is, whether the frozen dynamite was dense and solid or loose and pulverulent; in the former case explosion not being usually obtained, and in the latter almost invariably.

Returning to this subject this last winter, I have made a number of experiments. Their result has been quite different from that derived from the work of a year ago. Explosion has been produced nearly always, but there were still instances when it was not brought about.

The fuses used were fulminate or detonating fuses. Most of them were made at the station, but also some made by J. H. Striedinger, civil engineer, of New York, were employed for purposes of comparison. I have in a report of this date indicated the result of this comparison. Both kinds were low-tension electric fuses charged with fulminating mercury. The dynamite used contained 75 per cent. of nitro-glycerine, and was nearly all prepared in the summer and fall of 1877 from nitro-glycerine made during the same period. The thawed dynamite was closely packed in tin cans, in the amounts desired (1 to 7 pounds), and fuses inserted. After freezing had taken place, the cans were fired in 8–12 feet of water, or in the open air, in connection with an apparatus for measuring the force exerted.

In 48 trials, explosion was produced 45 times and failed to occur 3 times (18 trials with the Striedinger fuses, and 1 failure; 30 trials with station fuses, and 2 failures). In the cases of failure to explode, there was no seeming defect in the fuses, for they were fired, tearing open the cans, scattering the contents.

At this time, then, simple fulminate fuses have been much more effective in frozen dynamite than the same fuses were a year since. This may be due to a difference in the explosive used on the two occasions. I have shown by many experiments that liquid nitro-glycerine does vary in sensitiveness, as also the dynamites prepared from different makes of it. These differences are not great with an article made as carefully as the nitro-glycerine prepared at this station, but they become of importance when dealing with the frozen substance, since then explosion is much less readily obtained. Again, two different lots of absorbent were employed in making up the dynamites. Variations in the absorbent, the proportion of nitro-glycerine being the same, make the dynamite denser or lighter, wetter or drier, coarser or finer, and such variations in mechanical condition exercise a powerful influence on the explosibility of the frozen material, as a loose, pulverulent frozen dynamite will almost always, if not invariably, be exploded, while a dense, solidly frozen mass will stand a good chance of not being fired. Thus the dynamite used in the last experiments was much drier in its normal state, and when frozen was looser and lighter than that of a year ago. As might have been expected, explosion was much more easily produced.

But still the fact remains that explosion is not always accomplished under such conditions. We must therefore conclude that the firing of nitro-glycerine preparations in the frozen state is much more difficult

than in the usual or thawed condition, and that it is not certain that it will be brought about by the fulminate fuse, which surely and reliably accomplishes it when they are not frozen.

The consideration of the means by which the explosion of frozen dynamite may be insured I leave until another time. I hope to have the opportunity to recur to this matter and work it out more fully.

During the last winter we have had very little really cold weather. Dynamite has frozen but lightly, comparatively speaking, in the magazines, and some samples of nitro-glycerine in the same place, in a wooden case, have remained liquid all winter.

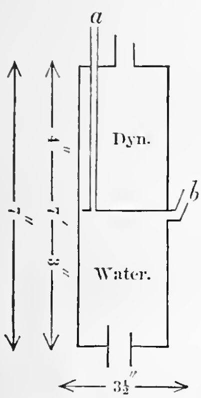
Very respectfully,

WALTER N. HILL.

Capt. K. R. BREESE, U. S. N.

TORPEDO STATION, *March* 15, 1878.

SIR: In accordance with your direction, I submit the following description of an apparatus for comparative measurements of the force of explosive agents and the experiments thus far made with it:



A can of the shape indicated by the sketch is divided into two chambers; the upper receives the charge; the lower is filled with water by means of a tube leading up through the chamber above; there is a short exit-tube at the top of the water compartment; water is poured in through the tube (a) until it freely flows out through the exit (b) (care being taken that all air escapes), which is then closed by a cork. A ring on the bottom of the can enables it to stand steadily on the measuring arrangement. This consists of a spiral pressure-gauge contained in an iron block; the opening in this block is closed by a large nut with a central hole, in which fits a plunger; this plunger has the shape  Its lower end rests upon the piston of the gauge, and upon its upper (1-inch diameter) is placed the can.

In this way a layer of water of known thickness is interposed between the charge and the gauge. The iron block is placed on the sand in air, with the plunger up, and upon this the can.

The intention of this arrangement is to measure only the initial blow; that is, to get an idea of the effect first derived from a submarine explosion, as distinguished from the effect due to the movement of the water by the escaping gases. ["Onde comprimée violente," Audic—Effets des explosions sous-marines.] This first and violent blow is peculiarly marked in the explosions of the detonating bodies (dynamite, gun-cotton, &c.), and its effect must be principally relied upon for destructive work at some distance from the center of explosion. We may therefore use this method to relatively determine the force thus transmitted and the loss it experiences during transmission. Also, it would seem probable that we shall be able to arrive at a good relative comparison of the detonating explosives; a result greatly to be desired.

Some preliminary experiments in January, 1877, with various methods, indicated the one described as the best, but there has been no opportunity to go on with the work with it until recently.

The experiments now made have been mainly to try the method to see if concordant results were obtainable by it, and have been nearly all made with frozen dynamite, in connection with other work with that material. The following are among the results obtained:

Explosive.	Time made.	Amount.	Containing nitro-glycerine.	Condition.	Pounds indicated.	Remarks.
		Oz.	Oz.			
Dynamite, 75 per cent	Same	20	15	Frozen	40,800	Plunger upset.
Do	Same	20	15	Thawed	40,400	Do.
Do	Oct. 24, 1877	20	15	Frozen	45,600	Do.
Do	do	20	15	do	42,800	Do.
Do	do	20	15	do	40,000	Do.
Do	do	20	15	do	42,000	Do.
Do	Sept. 17, 1877	20	15	do	34,000	Do.
Do	Feb. 28, 1878	20	15	do	35,600	Do.

The figures in the 6th column are obtained by multiplying the readings of the disks by 4, the No. 2 gauge having been used. In every case the top of the plunger was more or less upset. This would, of course, cause some variation in the cuts, the plungers being different and varying in resistance. Allowance may be made for this, but I think there will be no difficulty in remedying it in the future, as that allowance will not be required. But allowing for such variation, the agreement is satisfactory.

In Nos. 1 and 2, the difference is very small, and it is noteworthy that in both the same dynamite was used, one charge being frozen and the other thawed. It may be inferred, therefore, that as perfect an explosion (detonation) was obtained in one case as in the other. Nos. 3 to 6 are from one lot of dynamite in same amounts as before, and the figures are reasonably close, under the circumstances, and accord with the preceding ones. Nos. 7 and 8 are of different lots and give results considerably less than the others, although nearly like one another. Very probably in these preparations the explosion was less perfect (*detonation* not obtained). I have often been convinced that this was the case with frozen dynamite at certain times, but have not been able to show it before. Evidently, if the same dynamite, thawed, gives steadily higher results, it is proved. Other comparisons, such as relation of amount of charge to space occupied by it, &c., are plainly possible.

Some other trials have been made, but not given here, as their results are not comparable without further experiment. But these results show that we have an excellent mode of comparing together explosive agents, and particularly in relation to their use in submarine work.

As the experiments are continued I hope to be able to present some conclusions in regard to some of the points raised.

Very respectfully,

WALTER N. HILL.

Capt. K. R. BREESE, U. S. N.

UNITED STATES TORPEDO STATION,
Newport, R. I., March 15, 1878.

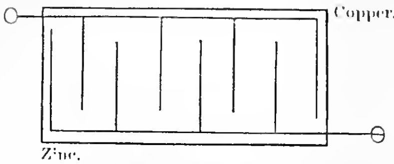
COMMODORE: Professor Hill informed me of a "patent safety mine" that he had just seen described in a January London Times, and said

that he would like to try it. He was authorized to do so, and the following report shows the result:

Capt. K. R. BREESE:

SIR: The experiment described below, made with a circuit-closing battery for contact torpedoes, has shown that such an arrangement is practicable, and will evidently be useful in certain cases.

A wooden box (paraffined) 4 by 5½ by 3½ inches deep (inside) contained two plates, zinc and copper, set on edge and presenting a large surface thus—



The outside line represents the wooden casing of box.

Directly over the plates was placed a glass flask or bottle, containing a solution of chromic and nitric acids (battery fluid), and this was covered and inclosed by a leaden cap which was fastened to the box. A fuse and about one hundred feet of leading wire were connected to the terminals of the plates. On striking smartly the leaden cover, the flask was broken and the fuse instantly fired. The battery fluid coming in contact with the plates set up a powerful current and also closed the circuit on the fuse.

Thus is obtained a compact, simple, and effective exploding arrangement for automatic contact torpedoes, and one which avoids all the dangers of the ordinary mechanical methods; for the connection between the fuse in the charge and the firing apparatus may be made by a wire and may be kept broken until the torpedo is planted and then completed from a suitable distance.

A wire may also be led from shore to the same fuse, so that in special cases the power of firing at will may be added to the contact method.

This plan is perhaps worthy of further experiment to devise the most suitable arrangement. Smaller battery plates would be sufficient, so the affair may be of small size. It might also be desirable to see whether sea water could not be made to answer the purpose of a battery liquid. The plates would have to be much larger in that case.

A contact torpedo with a firing arrangement similar to this has been recently used by the Russians. A correspondent of the London Times (January 1878) mentions such a "patent safety mine," and this statement led me to make the experiment detailed above.

Very respectfully,

WALTER N. HILL.

Respectfully, your obedient servant,

K. R. BREESE,

Captain, U. S. N., Inspector Ordnance, in Charge of Station.

Commodore W. N. JEFFERS, U. S. N.,

Chief of Bureau of Ordnance, Washington, D. C.

UNITED STATES TORPEDO STATION,

Newport, R. I., March 30, 1878.

COMMODORE: I have to forward herewith a plan of Lieut. J. S. Newell, for a testing and firing plate, and would respectfully recommend its adoption in place of the switch-boards now furnished to ships.

So long as the D. E. machines are furnished to ships, it is well to have the firing-key belonging to them, and I would not therefore recommend its discontinuance for the present, although it would scarcely ever be used.

Respectfully, your obedient servant,

K. R. BREESE,

Captain, U. S. N., Inspector of Ordnance, in Charge of Station.

Commodore W. N. JEFFERS, U. S. N.,

Navy Department, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., April 4, 1878.

COMMODORE: The following is the estimate for making a testing and firing plate, upon the plans of Lieutenant Newell:

Plate with hemispherical brass cover	$40 00
Two keys	10 00
Electric bell (to be purchased)	5 00
Pedestal, brass	50 00
Patterns for castings	10 00
	115 00

The plate, the finishing and putting together can be done here. The castings and brass cover would be made in Providence. If the pedestal is of wood of course the expense would be much less, and again if a number were to be made the cost would be much reduced.

Respectfully, your obedient servant,

K. R. BREESE,
Captain, U. S. N., Inspector Ordnance, in Charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., March 28, 1878.

SIR: In obedience to your order, I beg leave to submit the accompanying plan in detail of a testing and firing plate, a sketch of which was submitted to you on the 14th instant.

The service outfit of to-day includes a firing key and two switch-boards.

The latter are generally placed under the bridge of a ship, and the permanent wires led from them. By their construction and position an assistant to the operator is required, thus furnishing a source of failure or error.

The firing key designed to be used with the D. E. machine issued, is kept stowed in the box with the machine, and when required for service is taken to some convenient place and rigged. From it wires must be led; two to the machine, two to the switch-boards, and one to make an earth connection. These are led as advantageously as possible; yet they are liable to encumber the decks and be an annoyance to the operator if not to the crew. The construction of the key requires that when in use the needle shall point in the direction of the length of the box, which necessitates that the length of the box shall be in the plane of the meridian. Unless the ship is stationary or moving in a straight course, the box must constantly be shifted to fulfill this requirement, or else the needle may fail to indicate the passage of a current. It is essential that the test signal, whatever it may be, should be distinguishable at all times. This key furnishes no evidence of the passage of a current, except when the needle is visible. Again, to accomplish an explosion the operator must use both hands.

All these are sources of error, and to fulfill all these requirements will be at times annoying.

The plan proposed combines these two instruments and eliminates the sources of error, combining all operations under the personal control of one person, the operator.

It is intended that this plate shall be permanently placed in some suitable location, mounted on a hollow pedestal, through which the permanent wires converging to this point shall pass.

The apparatus is shown in figures I, II, III, and IV.

Fig. I is a top view. A A_1 A_2 A_{12} is a brass plate, 12 inches diameter and $\frac{3}{4}$ inch thick, divided into the sectors A A_1 A_2 A_{12} and the ring B. These are insulated from each other by ebonite. A is intended as a locker for the pins; A_{12} carries the short circuit and testing-key T; A_1 A_2 A_{10}, sectors to which permanent wires are attached, as A, starboard forward torpedo; A_2, port forward torpedo; A_9, starboard aft, and A_{10}, port after torpedo. Connection is made between any sector and the ring B by the introduction of a pin in the appropriate hole K. C is a hollow space with a thin covering for protection, under which the test alarm is placed.

Fig. II is a section through A and A_{12}, showing testing and firing keys and their connections. D is an ebonite insulator, 12 inches diameter and 1 inch thick, insulating the upper plate from the base-ring E, which is a brass ring 12 inches diameter and $\frac{1}{2}$ inch thick; L, a locker for the pins; R, a resistance introduced in the testing circuit in the bell magnetic coils; S, the gong.

Fig. III is a section through A_5 and A_6, showing the pins P in place for connecting these sectors with the ring B; also, shows the manner of securing the plates together and to the pedestal; also, how the permanent wires arrive at their proper sectors.

Fig. IV is a bottom view of sectors A_6 and A_4, showing these sectors by dotted lines and the plate E by full lines, the distribution of the screws, and the passage for the permanent wires.

The whole is mounted on a hollow pedestal and the plate has a hemispherical cover, resembling a compass outwardly.

The D. E. machine now issued requires a short circuit, which is readily furnished by the testing-key, which is a circuit-continuity-preserving key. It is presumed that the machine will be operated from some permanent place. In this place are secured two binding-screws, to which the machine will be connected by short wires for service; Fig. II, these binding-screws are shown at m m'. From these permanent wires are led to the plate; the one from m' is connected to the bolt b, which is insulated from A_{12} by ebonite, and the wire from m to the post c also insulated from A_{12}. On b a lever, a, is pivoted, which in its normal position rests on c, held there by the spring y. The short circuit shown in full black lines in the Fig. II is then from the machine to m', to b, by a to c, back to m, and to the machine.

Desiring to test, a pin is first put in position, connecting the proper sector with the ring B. The resistance R has one end connected to the ring B at the post t; the other end is connected to the bolt d, which extends through all the plates—that is, A_{12} and the base-ring E—well insulated from both. On the upper end it serves as a pivot for the lever e, and the lower end as a contact point for the key F. On pressing the testing-key T contact is made between the levers a and e before the short circuit is broken between a and c. The normal position of lever e is as shown in the figure. This is maintained by the spring y'. The testing-circuit is then (shown in the figure by a full red line) from the machine to m', to b, by a to e, to d, through the resistance to the ring B, by the pin to the sector, and through the permanent wire to the object and earth. The post m has an earth connection, by which the return path to the machine is secured. If the circuit is complete and a current

passes, it will be indicated by the striking of the bell, a notice distinguishable by day or night.

To fire, the key F is lifted to contact with *d* at *h*; the screw *j*, insulated from the base E, opens a path to ring B of comparatively no resistance, practically shunting out the resistance R. The key T being pressed, the circuit is, as shown by the black dotted lines, from machine to *m′* to *b*, by *a* to *e*, by *d* to *h*, by key F to *j* and to B, by pin to sector, permanent wire to object and to earth, returning by *m* to machine.

The keys are purposely placed as shown, T being more accessible on top, and if accidentally struck no harm ensues; F underneath is more protected and will hardly be closed, except intentionally. Both keys can be operated by the same hand.

To prevent accidental contact between any two sectors or between any sector and the ring B, the insulation is carried between these above the plate, as shown at *o*; this might happen by the careless laying of any metal on the plate.

The use of the machine complicates it, for if a battery was used the key T would be dispensed with and the mere insertion of a pin would test, and the lifting of F would fire, thus simplifying the connections.

This size is taken for convenience, as the plate could be larger or smaller and accomplish the same; again, it was divided as shown to illustrate that a large number of sectors could be arranged thus.

The connection of the permanent wire, as shown in Fig. IV, is secured by spreading out the wires of a multiple conductor, and soldering them star-fashioned to the bottom and side of the sector, to the side, so that if necessity demanded the enlargement of applications the sector could easily be cut in half with the radius and pin-holes made as shown at K′ and K″, Fig. I. This could be easily done with the facilities found on board ship, thus doubling the number of applications, a necessity in case of a defense of a disabled ship.

This is as applicable to guns as to torpedoes; a slight change in the arrangement would answer. In use with guns it might be necessary to distinguish which gun is ready; this might be done by inserting in the sector the distinguishing number of the gun as P 1, S 2, on a small piece of ground glass with the number etched in; when the testing circuit was completed a battery would be closed upon a strip of platinum under the glass, reddening it, illuminating the number, and ringing a gong.

It may be difficult on very dark nights to readily distinguish the proper sector or hole for the pin; to obviate this a small lamp could be attached to A, reflecting only its light upon the plate.

If a battery is used a number of these can be placed in different parts of the ship and act independently of each other, branches leading to them from the permanent wires.

It is evident that any number from one to all can be fired at the same time without distinction.

This instrument possesses the following advantages over the present methods:

First. Simplicity, one instrument doing the work now done by two.

Second. Compactness, the whole being centralized at one point.

Third. Efficiency, one operator instead of a number, available at all times and applicable to guns as well as torpedoes, and more readily worked.

It is also believed that the cost would be less.

It would be more convenient to make the connections by short pieces of wire, a multiple conductor, double silk insulated of five or seven

strands; these wires to be tallied and spliced to the permanent wires on board ship below the pedestal after the plate is in position.

Very respectfully submitted.

J. S. NEWELL,
Lieutenant and Assistant Inspector of Ordnance, U. S. N.

Approved and respectfully referred to the Chief of Bureau of Ordnance.

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in Charge.

I.

UNITED STATES TORPEDO STATION,
Newport, R. I., June 1, 1878.

ASSIGNMENT OF THE OFFICERS OF THE STATION TO DUTY.

Capt. K. R. Breese, U. S. N., inspector of ordnance, in charge of station.
Capt. F. M. Ramsay, U. S. N., inspector of ordnance.
Lieut. Commander C. F. Goodrich, U. S. N., senior assistant inspector ordnance, instructor in electricity and diving, in charge of Nina and boats.
Lieut. Commander H. Elmer, U. S. N., chemistry and explosives.
Lieut. J. S. Newell, U. S. N., assistant inspector of ordnance, instructor in torpedoes.
Lieut. W. Maynard, U. S. N., assistant inspector of ordnance, instructor in fuses and electricity.
Lieut. A. R. Couden, U. S. N., assistant inspector of ordnance, instructor in electricity.
Gunner William Burditt, U. S. N., in charge of machine-shop.
Prof. M. G. Farmer, electrician.
Prof. W. N. Hill, chemistry and explosives.

II.

COURSE OF INSTRUCTION.

[Embraces the months of June, July, and August.]

The attendance of officers for instruction will be from the 9.30 a. m. to the 2.30 p. m. boat.

The day is divided into two periods:

First period from 9.45 a. m. to 11.45 a. m.

Second period from 12.15 p. m. to 2.15 p. m.

The following division of time will be observed, unless due notice is given of change:

	First period, 9.45 a. m. to 11.45 a. m.	Second period, 12.15 p. m. to 2.15 p. m.
Monday	Electricity	Electricity.
Tuesday	Torpedoes	Chemistry or explosives.
Wednesday	Electricity	Electricity.
Thursday	Chemistry or explosives	Torpedoes.
Friday	Torpedoes	Examination papers.

The whole or part of a class will be assigned to a period, due notice of which will be posted in the ferry-launch and in the officers' room at the machine-shop.

III.

The officers under instruction will be divided according to rank in two parts, and will be known as the senior half and junior half.

Any change of programme from the established order will be posted in the officers' room at the machine-shop.

Pocket note-books will be furnished the class for daily notes, and a blank-book for each branch of instruction, in which drawings and examiaminations will be recorded.

Questions bearing upon the lectures for the week will be posted the day of the lecture; and the replies, carefully given and neatly written in the blank-books, furnished for the purpose, must be left in the officers' room on Monday morning to be taken to the commanding officer.

The books will be examined by the instructors, errors noted, and then returned by the commanding officer, with such remarks as may be deemed necessary.

The final examination will be of a practical character before the Board of Visitors, and the books of the class are to be submitted to the Board.

Opportunity will be given to officers to practice in diving and submarine work connected with torpedoes; and, at the close of the term, such officers as show themselves proficient will receive certificates as divers.

Officers who desire to continue their studies will be (if circumstances permit) allowed to remain and be attached to the station.

The course as above prescribed has been approved by the Chief of the Bureau of Ordnance and the honorable Secretary of the Navy.

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in charge of Station.

IV.

The officers in attendance at the course of instruction are notified that the course will commence at 9.45 a. m. on Monday, June 3, and continue, as posted daily in the ferry-launch and officers' room, until its close, about the end of August.

Books similar to those issued to the officers under instruction will be issued to the officers in attendance for their personal use and advantage; and, if they desire, the instructors will gladly correct any errors they may have committed in them.

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in charge of Station.

DIVISION OF THE CLASS OF OFFICERS UNDER INSTRUCTION.

Senior half.—Lieut. Commanders W. S. Dana, C. H. Pendleton, G. D. B. Glidden, Edwin White, Felix McCurley, C. H. Rockwell.

Junior half.—Lieuts. Frank Courtis, E. E. Pendleton, C. O. Allibone, T. H. Stevens, A. M. Thackara; Masters Nathan Sargent and Henry McCrea; Ensign M. L. Wood.

LIST OF OFFICERS IN ATTENDANCE.

Commanders O. F. Stanton, C. C. Carpenter, E. E. Potter, G. C. Remey, H. B. Seely, and A. S. Barker.

Lieut. D. P. Mannix, U. S. Marine Corps, availed himself of the permission of the bureau to attend the course of instruction.

TORPEDOES FOR ATTACK AND DEFENSE OF VESSELS, WITH AN OPINION OF THOSE IN USE, AND A SUGGESTION FOR A NEW PLAN.

The history of torpedoes shows a large proportion of failures, and the destruction or imminent risk of the boats employed. Any fast vessel fitted with a bow-spar and not having the strength to ram an iron-clad, would be obliged to slow down on approaching such a vessel, both for her own safety and for that of her spar; giving the vessel attacked greater opportunity to cripple the boat, or to obstruct and break the torpedo-gear. It would seem that the only form of bow-torpedo of practical use, is a heavy machine-bar, worked below the water line, not dependent on exposed guys, and fitted in the ram-bow of a fast and powerful compartment vessel, capable of pushing through all obstructions, and would be simply auxiliary to the ram.

Vessels fitted with side-spars are expected to maneuver so accurately as to pass alongside or astern of the enemy without slacking speed, and at just such a distance as to place the torpedo against her side or under her counter, where it is exploded by electricity at the instant of touching, and before it is broken off and alongside your own vessel—delicate accuracy in action—or by closing circuit by strain on forward guy, or to let go the torpedo end of spar from alongside and make a flying shot when passing.

This is very good in theory, but the experience of many experiments by vessels of all sizes attacking undefended, stationary, and brainless targets, with deliberation and at slow speed, have proved how difficult it is to judge of the distance, and what little chance there would have been in actual warfare of placing the torpedo against the enemy's side and firing at the proper time. Any accident to the cumbrous boom, guys, or topping-lift would be fatal; and even with a machine side-bar, firing by contact, the difficulty of accurate steering or the fouling of any obstruction would prevent a successful accomplishment. Although superior to the wooden bow-spar, and possibly of some use for defense, the side-spar torpedo would be a total failure against a properly defended vessel at anchor, and of little practical use in attacking under way.

The Lay, the Ericsson, and other automatic torpedoes which may be seen on the surface as well by the attacked as the attacking party, and are so easily avoided, intercepted, or obstructed, are of no practical use whatever.

Fine shooting has been made with the Whitehead from a stationary platform at a fixed target, but give both platform and target a speed of 12 knots in varying directions, and a far different result would appear. Fired with precision at close quarters, a Whitehead might strike its object, if unobstructed. No successful use seems to have been made of it in the last war, although a few were found drifting about, and the only *reported* instance of its use was in the Huascar-Shah engagement, where its direction was observed by bubbles on the surface, and was avoided by a change of course. If great speed can be attained by a fish torpedo (as said to be the case in Ericsson's last), and if it can be accurately aimed and projected in the heat of action—allowing for the speed of the two vessels—and if no obstruction can be devised for the attacked vessel to use, it is a good thing.

Experiments have proved that the Harvey or other similar towing torpedo, would be almost impossible to control and guide in action, on account of its behavior when the course is changed, and the ease with which the towing-line is grappled and cut, unless a most accurate shot is made at a stupid adversary. And it is not likely that a commanding officer will wish to handicap his mental faculties with one of these affairs

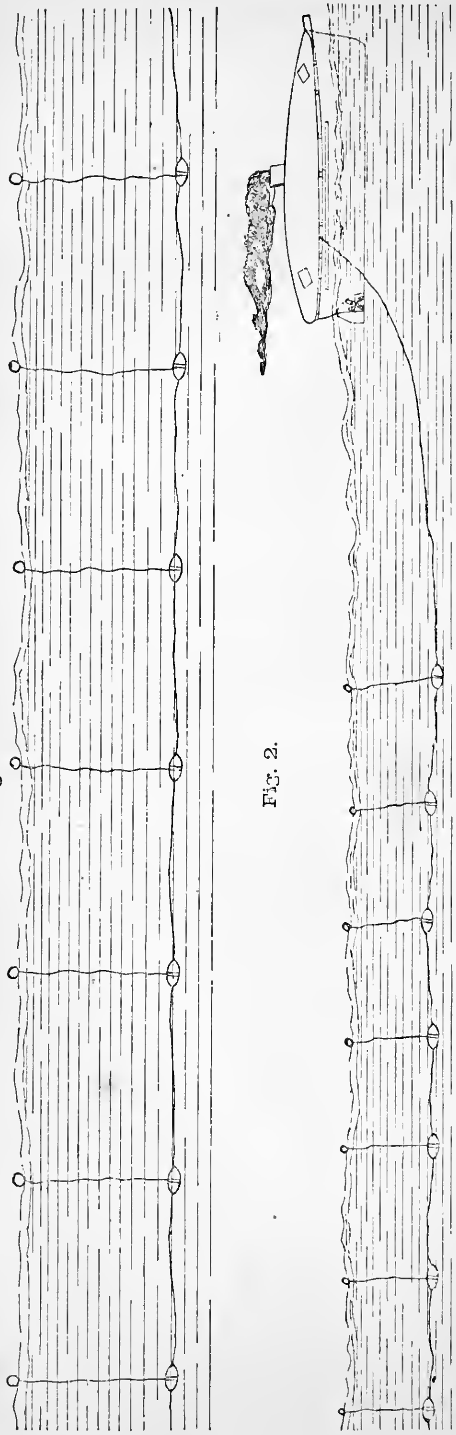


Fig. 1. Fig. 2.

on each quarter, for defense, liable to recoil upon him when he changes his course, and so easily avoided or cut away by the enemy.

Firing grapnels over vessels from passing launches, which would drag torpedoes alongside of them, has been proposed, and is said to have been the means by which a Turkish vessel was destroyed in the Danube; but against a properly protected vessel there would be many chances of failure to one of success.

The history of submarine boats for the attack of vessels is thus far but a melancholy recital of costly failures and loss of life.

Drifting torpedoes have been tried in great numbers, and for many years; sometimes two were connected by a spar, but these probably drifted together or assumed a position parallel to the current. These torpedoes have all been fitted with automatic fuses, and of the hundreds set adrift, but few have run foul of vessels, and there are only one or two instances of explosions or damage done. These last mentioned more properly belong to the class of torpedoes for defense of harbors.

Of this list of torpedoes, the machine bow-bar, auxiliary to a ram, and the Whitehead automatic, at close quarters, seem to be the only ones of practical value for attacking vessels of war that will hereafter be expecting and prepared for such annoyance.

The simplest form of a torpedo for attack or defense of vessels, being the most easily handled, and requiring the least amount of calculation and skill for effective work, would certainly be the best for actual warfare.

The electric fuse, also, which

never fails in skilled hands, and renders the torpedoes harmless until the moment you desire them to do execution, seems to be the only one to use in attack or defense under way, but the wires should be difficult to grapple and cut.

The plan I would offer for experiment (Fig. 1), which may appear to combine some of these elements, was suggested by drifting torpedoes, and by a single-buoyed torpedo for attack (designed by Admiral Porter), which had a strong firing-wire leading from the buoy to the vessel employing it.

On a strong light line, recently designed, which contains within it the firing-wires, are lashed at intervals of, say, 25 feet, six, eight, or more cases of sheet iron or steel containing each about 30 pounds dynamite, or 50 pounds guncotton, or equivalent explosive, the detonating ones being preferable. The cases to be made of a form to tow easily, should that become necessary, and when filled to have a little greater specific gravity than water, so each may be supported by a small rounded buoy easily dragged under surface obstructions. No line connects the buoys to each other, but they support the torpedo-line at 12, 15, or even 20 feet below the surface, according to the supposed obstructions and other circumstances. The firing-wires connect through a coil of spare line to the D. E. firing machine or battery in the boat employing it. (Fig. 2).

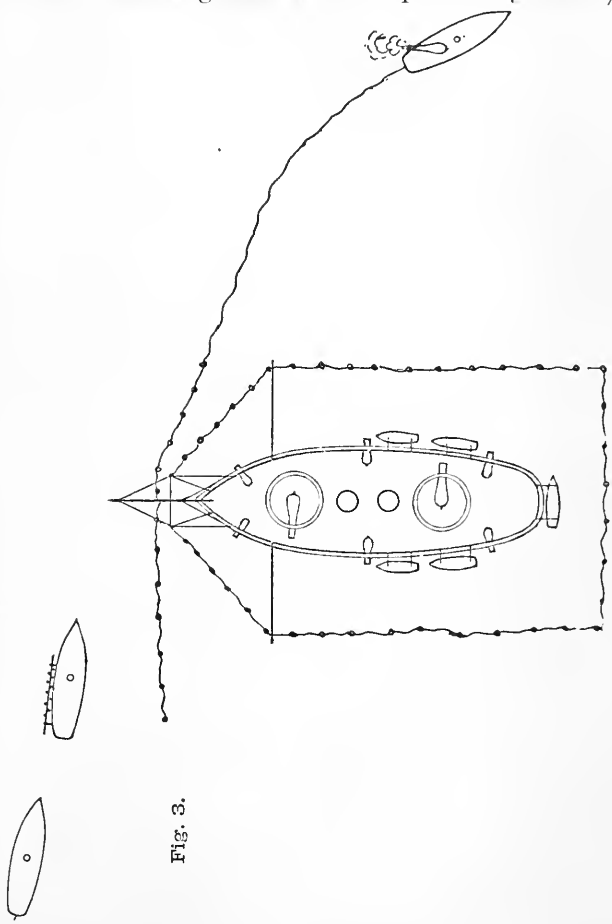


Fig. 3.

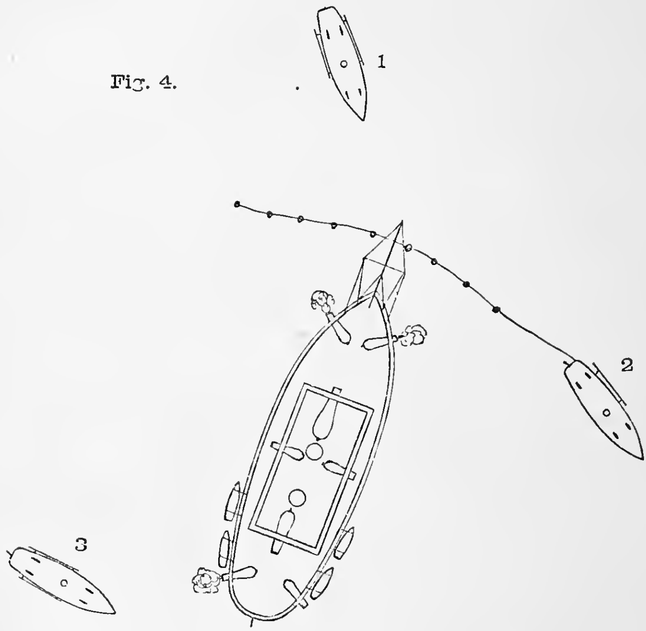
For attacking a vessel at anchor, a steam-launch or torpedo-boat having great speed, and protected from small-arms, &c. (of which there are many modern designs), would steer to cross her bow at full speed, having the line of torpedoes bighted up on an iron slipping-rod on the "off" side from the enemy, ready for paying itself out in a taut line as soon as the end torpedo is let go, which would be done on approaching, so that the line would be laid out with some torpedoes on either bow

(Fig. 3), and would continue on at full speed, paying out the extra coil, and then steer so as to bring the line against the enemy's bow, probably assisted by tide or current, and explode the whole line at once when it had fouled the vessel or her obstructions. A second attacking boat follows directly after the explosion of the first line, and if the obstructions only are destroyed the second line would probably involve the vessel herself.

Picket-boats, so much written of, unless they are steaming round and round their vessel at full speed, could not get up a velocity in time to interfere with the attacking boat, and even in the event of a launch combat, the vessel herself could not distinguish friend from foe at night, and a reserve torpedo-boat would involve her in another line.

To attack a vessel under way, tactics as represented in Fig. 4 might

Fig. 4.



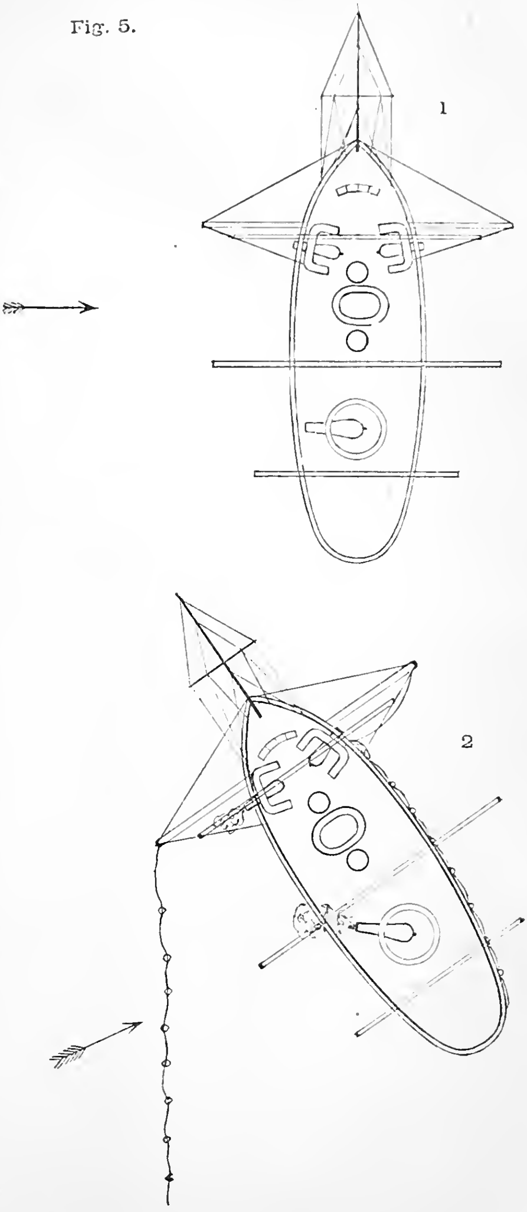
be employed—torpedo-boat No. 1 rounding the vessel's bow at full speed and slipping her line, while boat No. 2 is ready to head her off in case she cripples No. 1 or changes her course, or only has her torpedo-catcher blown off, and No. 3 steering for the stern of the enemy in case she can stop and back in time to avoid the lines ahead.

The advantages of this system of attack would be that the speed is not slackened near the enemy, and probably not at all; that no *fine* judgment is necessary in steering and in laying the torpedoes (as in all other systems of attack); that it would be very difficult to cut or intercept the line on account of its depth below the surface and the large number of torpedoes, and that no preparation or rigging-out is necessary near the enemy, but that one man has only to judge when to slip the first torpedo of the line. The torpedo-boat's screws would, of course, be protected to prevent fouling their own lines, or the Herreshoff center-screw boat would be an excellent thing for this purpose, combining great speed

with remarkable maneuvering power, one of them recently circling about the bows of a fast bay steamer with impunity.

For defense against rams, &c., an iron-clad could have a line of torpedoes rove through a block on a boom, forward, as in Fig. 5 (No. 1) with the buoys stopped along the side at the water-line, and the torpedoes under water. Suppose, then, a ram to be approaching her from any point on the port side; she would steer so as to bring it to bear nearly on the beam when nearing her (No. 1, Fig. 5, arrow), and would then starboard her helm and release the buoys from the side by a single slip-toggle, and continuing her way with starboard helm, the line would take the position in No. 2, Fig. 5, and could be exploded at will when the ram had fouled the buoys. If obliged to change her course the line would be slacked out, and a slip-line from the quarter to the running-port would haul it to the taffrail.

Fig. 5.



Such a line was experimented with in a crude way by the Alarm last winter. There being no boom forward and the speed low, the buoys had a tendency to tow alongside at first, but afterward stood out, and the torpedoes were fired in succession from the outer one, in.

If there should be any difficulty of their swinging out, the torpedo-line could be bighted together and hanging under water from the end of the boom, with the torpedoes towing in close order in line, when they could be shipped at the proper time and would then lay out nicely. This plan can be much improved, and is so suggested, a system for protection against rams being of great importance.

It is probable that a ram fitted with a false bow, and 50 pounds dynamite on a long machine bar, could detonate her way through a line of ordinary torpedoes and ram the vessel.

Fig. 6.

A vessel being pursued by another, might protect herself to some extent by towing a line of torpedoes astern and judiciously changing her course. (Fig. 6.)

To protect a vessel at anchor by lines of simple torpedoes, in addition to other defenses, has probably occurred to many. The easily-made torpedo-lines above described would answer very well for this purpose.

The previous remarks on those systems of attack and defense already in use, are submitted simply as a personal opinion, gathered from the history of their use, and observations of numerous experiments.

Very respectfully,

FRED'K H. PAINE,
Lieutenant, U. S. N.

NEWPORT, R. I., *July* 22, 1878.

Commodore WM. N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance.

Forwarded. Lieutenant Paine spoke of an exhibition to the Secretary from the Alarm of a defense by torpedoes against ramming, and I asked him to put it in writing for the benefit of the station.

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in charge.

TORPEDO STATION,
Newport, R. I., August 30, 1878.

SIR: During the course of instruction just completed there have been given 25 lectures of 2 hours each, and 14 periods of practical work, each period covering at least 2 hours.

Lectures have been delivered on the following subjects and in the order given:

One on the "manner and means of exploding torpedoes now employed in the service."

One on the "preparation of the service spar-torpedo for use."

Six on the "spar-torpedo" (description manufacture; and use of all articles connected with; permanent wires; torpedo-fittings for ships; splicing; experimental, service, and foreign boat; fittings; torpedo-boats; bow and beam fittings; comparison of bow and beam spars).

Five on "towing-torpedoes" (experimental, Harvey, foreign; comparison of different towing-torpedoes; mode of handling and defense against).

Four on "movable torpedoes" (mechanically-controlled launches, Ericsson's, Lay's, and others).

One on the "defense of ships against torpedo attacks."

Two on the "defense of harbors, clearing channels, and the removal of obstructions."

Two on the method of locating faults in service D. E. machines.

Two on "hand-grenades," "charges and effects," "effect of nets on contact mines," "improvised ground-torpedoes."

One general review.

The practical work has followed the lectures on the different subjects, illustrating their practical application.

Each member of the class has been required to—

1st. Detect and correct faults liable to occur in the electrical apparatus used in exploding torpedoes.

2d. In filling, fusing, and exploding a service exercise torpedo (5 pounds).

3d. In filling, fusing, and exploding from a boat, a service 75-pounder torpedo.

4th. In improvising and exploding a torpedo, using as a case jugs, cans, bottles, &c., provided for the purpose.

5th. In fusing, working, and exploding a service 100-pounder torpedo from a ship.

6th. In fitting, handling, and working the Harvey torpedo, making an attack upon a moving target (schooner), the target not trying to evade the attack.

7th. In making an attack with the Harvey torpedo against a target which was maneuvered to evade the attack.

Practical illustration was also given to the class of the working of movable torpedoes, mode of making a flying shot with a beam spar-torpedo from a fast torpedo-launch, and the working of mechanically-controlled launches and the effect of dynamite as an explosive used in spar-torpedo exploded from a launch.

Very respectfully, &c.,

J. S. NEWELL,
Lieutenant, U. S. N., Assistant Inspector of Ordnance, and Instructor in Torpedoes.

Capt. K. R. BREESE, U. S. N.,
Inspector Ordnance, in charge of Station.

UNITED STATES TORPEDO STATION,
Newport, R. I., August 31, 1878.

SIR: Lectures on the following subjects have been delivered before the class under instruction during the term now ending:

1. Definitions of terms and galvanic batteries.
2. Galvanic batteries, continued.
3. Electric currents.
4. Electric currents, continued.
5. Electric currents, continued.
6. Galvanometers.
7. Measurement of currents.
8. Laws of electric resistance.
9. Heating effects of currents.
10. Heating effects of currents, continued.
11. Measurement of resistance.

12. Measurement of resistance, continued.
13. Measurement of electro-motive force and battery resistance.
14. Measurement of resistance battery, continued.
15. Arrangement of battery-cells for particular purposes.
16. Magnets and magnetism.
17. Magnets and magnetism, continued.
18. Electro-magnetism.
19. Electro-magnetic induction.
20. Laws of electro-magnectic induction and description of Wilde's small machine.
21. Farmer's A machine.
22. Electrical apparatus of Lay torpedo-boat, No. 1.
23. Farmer's C machine, and how to arrange groups of fuses, so as to get the maximum effect from a known source of electricity.
24. Siemens's and Farmer's machines, considered as types of high and low resistance machines.
25. Description of Wheatstone's, Beardslee's, Breguet's, Gramme's, and Siemens's (Hefner-Altenek) machines.
26. Frictional electricity and frictional machines.
27. Comparative value of the various sources of electricity for torpedo purposes on board ship.

This course of lectures has been supplemented by a course of practical work of four hours per week. This has consisted principally of setting up batteries, measurements of electro-motive force, resistance of conductors and of batteries, electric currents required for particular work, using the various methods, measurement of machines, calculation of resistance from dimensions and material of conductors, calculation of number and arrangement of battery cells necessary to perform certain work, and other similar work. The lack of apparatus is very seriously felt in this practical work.

Very respectfully,

A. R. COUDEN,
Lieutenant and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

UNITED STATES TORPEDO STATION,
Newport, R. I., August 31, 1878.

SIR: The instruction in fuse-making for the term just ended has been as follows:

Each officer under instruction has been required to make five service "D. E." igniters; three service fuses; one "M. E." igniter; one "F." igniter; one each of Bradford's, Barber's, Moore's, and Pillsbury's improvised fuses, and one original improvised fuse.

Instruction has been given in the method of testing fuses for the defects likely to occur in them, and as to the selection of wire or other material suitable for making the bridge of an igniter.

Lectures have also been delivered upon the following subjects:

1. The various methods of determining the position of a vessel with reference to any torpedo or group of torpedoes in a defensive system, by observation or intersection, the arrangement of the torpedoes and cables, and the electrical apparatus used in testing and exploding such a system.
2. The construction and use of circuit-closers, circuit-breakers, and

circuit-shunts, the English shutter apparatus and Converse's circuit-indicator, and the arrangement of batteries and circuits for use with those instruments.

Four hours per week have been given to this instruction.

Very respectfully, your obedient servant,

WASHBURN MAYNARD,
Lieutenant and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, commanding Station.

UNITED STATES TORPEDO STATION,
August 31, 1878.

SIR: Two courses of lectures have been given in the chemical department during the time of instruction just finished. The subjects of these lectures have been:

CHEMISTRY.

1. Chemical theory; quantivalence; symbols; formulæ.
2. Equations; classification of the elements; oxygen.
3. Atmosphere; ozone; hydrogen.
4. Water; natural waters.
5. Methods of water analysis; purification of water; nitrogen.
6. Compounds of nitrogen and oxygen; compound radicals; acids.
7. Nitric acid; ammonia and ammonium salts.
8. Fluorine; chlorine.
9. Chlorates; hydrochloric acid; bromine and iodine.
10. Sulphur; compounds of sulphur; sulphuric acid.
11. Phosphorus; arsenic; antimony; silica and silicates.
12. Carbon and oxides of carbon; making liquid carbonic acid and its use.
13. Organic chemistry.
14. Metals; metallurgy; smelting; metallurgy of iron.
15. Electrical chemistry.

EXPLOSIVES.

1. Explain reactions and effects; composition of explosives.
2. Gunpowder: saltpeter, sulphur, charcoal.
3. Gunpowder: processes of the manufacture; proportions.
4. Gunpowder: products of explosion; temperaturo; pressure and work.
5. Nitro-glycerine; glycerine; chemical relations of nitro-glycerine.
6. Nitro-glycerine; dynamite.
7. Dynamite; gun-cotton.
8. Gun-cotton; picric acid.
9. Picrates and picric powder; fulminate of mercury; chlorate mixtures.
10. Fuse compositions and mixtures; chloride, bromide, and iodide of nitrogen; explosive agents in torpedoes.

Interleaved copies of the pamphlet "Notes on Explosives" were supplied to the class, and the lectures on this subject were in addition to or in explanation of the matter in the pamphlet.

For the assistance of the officers of the class, printed sheets, giving abstracts of the lectures on chemistry, were furnished them for use in getting notes of the lectures.

A copy of the notes and a set of the printed sheets is appended.

Very respectfully,

WALTER N. HILL,
Chemist.

Capt. K. R. BREESE, U. S. N.,
Commanding Station.

Questions for examination, 1878.

TORPEDOES.

1. Give the torpedo outfit, and explain the service 100-pounder (construction and handling); the 100-pounder socket and mode of attaching to spar; the spar with its attachments (Museum). Fire 100-pounder from Nina.

2. Explain the service 75-pounder torpedo; 75 pounder socket and mode of attaching to spar and the present boat-fittings (Museum.) Fire 75-pounder from launch No. 2.

3. Explain the manner of filling, fitting, fusing, and firing torpedoes, illustrating by fitting a fuse and exploding it in a spindle, using machine No. ——. (Torpedo room.)

4. Give contents, and explain their use, of wire boxes; what distinction is made between them and why? (Museum.)

5. Explain use and lead of permanent wires; what kind of wire is used; explain terminal electric switch and the testing and firing-plate. (Torpedo room.)

6. Explain service wire, object of and how insulated; and method of making splices and insulating them—simple, fork, and cross splices. (Torpedo room.)

7. Explain the Harvey towing-torpedo—mode of handling, fitting and means of firing and the defense against the same (Museum) with practical use from Nina.

8. Explain the Danish, French towing-torpedoes, and compare them with the Harvey. (Torpedo room.)

9. Explain the Ericsson torpedo. (Lay boat-house.)

10. Explain the Lay torpedo No. 1.

11. Explain the Lay torpedo No. 2.

12. Explain monitor and tug fittings.

13. Give contents, and explain their use, of supply-box.

14. Explain the "A" machine.

15. Explain the firing-key.

16. Explain the "C" machine.

17. Explain system of defense against torpedoes.

18. Explain system of clearing channels and removing obstructions.

19. Explain exercise torpedo—what for and how it is used, and fire one from launch No. 3.

20. Explain boat-fittings other than service.

21. Explain manner of breaking chains and the construction and use of hand-grenades.

22. Explain various towing-torpedoes experimented with here—objections to the Harvey and reasons.

23. Various foreign torpedo-fittings for the use of spar-torpedoes either ahead or abeam, and a comparison of the two methods.

24. Test permanent wires and apparatus connected for continuity.
25. Test reel of wire and spar leading for insulation.
26. Give rules for and find fault in "C" machine No. ——.
27. Give rules for and find faults in wires.
28. Give rules for and find fault in "A" machine No. ——.
29. Give rules for and find faults in firing-key No. ——.
30. Illustrate and explain attack against a vessel moored head and stern with the Harvey.
31. Illustrate and explain attack against a vessel at single anchor with the Harvey—crossing the bow.
32. Illustrate and explain attack against a vessel at single anchor with the Harvey—passing on either side.
33. Illustrate and explain attack against a vessel at single anchor with the Harvey—coming up astern and passing on either side.
34. Illustrate and explain attack against a vessel under way with the Harvey—not maneuvering to avoid—from ahead.
35. Illustrate and explain attack against a vessel under way with the Harvey—maneuvering to avoid—from ahead.
36. Illustrate and explain attack with the Harvey against a vessel under way—not maneuvering to avoid—from astern.
37. Illustrate and explain attack with the Harvey against a vessel under way—maneuvering to avoid—from astern.
38. Illustrate and explain attack with the Harvey against a vessel under way—not maneuvering to avoid—by crossing the bow.
39. Illustrate and explain attack with the Harvey against a vessel under way—maneuvering to avoid—by crossing the bow.
40. Illustrate and explain attack with the Harvey against a vessel under way—not maneuvering to avoid—by crossing the bow.
41. Illustrate and explain attack with the Harvey against a vessel under way—maneuvering to avoid—by crossing the stern.
42. Illustrate and explain making a flying shot with the Harvey.
43. Illustrate and explain the defensive use of the Harvey.

QUESTIONS IN ELECTRICITY AND FUSES.

1.

1. Explain the construction of the D. E. igniter and fuse.
2. Give the dimensions of the material of the bridge.
3. Explain the action of the fuse in a torpedo.

2.

1. Explain the testing apparatus and the manner of testing an igniter, giving the limits allowed for the service igniter.
2. Give the requisites for a wire suitable for the bridge of a "fine-wire bridge" igniter.
3. What is an "improvised fuse"? Explain how they can be made.

3.

1. What are the advantages of a "fine-wire bridge" igniter?
2. Explain the construction of a detonating fuse, and for what purpose it would be used.
3. How would determine current necessary to do any particular work.

4.

1. Explain the construction of a high-resistance plumbago or M. E. igniter.
2. What defects are liable to occur in the service D. E. igniter and fuse?
3. How does heat developed in conductors by electricity vary? $H = R S^2 t$.

5.

1. What are the disadvantages of a high-resistance plumbago igniter?
2. Given a length of wire whose electrical properties are unknown, and a Farmer C machine, how determine whether the wire is suitable for the bridge of an igniter to be fired by that machine?
3. How is advantage taken of the heating effects of currents in firing torpedoes?

6.

1. Explain the construction of a fuse-measuring apparatus which could be made on board ship.
2. What defect in a service D. E. igniter would the test of the "firing-key" fail to discover, and how could it be found?
3. What general rule should guide in the arrangement of battery-cells in order to get the maximum effect?

7.

1. What are requisites in a good battery?
2. What are the electrical dimensions of a battery, and how are they measured?
3. How does the resistance of conductors vary?

8.

1. Explain the use and advantages of Wheatstone's bridge.
2. How does temperature affect resistance of metals and liquids?
3. What are principal substances used for insulating conducting wires?

9.

1. How does pressure of superincumbent water affect insulation of gutta-percha insulated cables?
2. What are principal objections to friction as a source of electricity for torpedo uses?
3. Describe station battery.

10.

1. Describe Converse's modification of Le Clanché cell.
2. What batteries are best fitted for use on shipboard?
3. What advantages and disadvantages have batteries as compared with machines for torpedo purposes on board ship?

11.

1. Having a source of electricity (machine or battery) whose E. M. F. is 16.8 volts., and internal resistance of 3.5 ohms, how many fuses, each

having .75 ohms resistance, and requiring .6 veber to fire, can you fire using leading-wires having .5 ohms resistance?

2. Give general descriptions of Farmer's A and C machines, giving average E. M. F. and int. res.

3. How do leaks and branch circuits of any sorts affect the total resistance of a circuit and current in simple parts, and how is current divided among the branches?

12.

1. Why is it that with service machines you can explode a fuse through leading-wires of naked wire in salt-water of moderate length? Could you still fire if your leading-wires were not only naked but in contact with each other?

2. Describe manner of the setting up of batteries; why amalgamate zinc?

3. Describe instruments used in electrical measurements.

13.

1. Give formula for strength of current, and explain meaning of E. M. F., current and resistance.

2. How may battery-cells be arranged, and what is effect?

3. What care should batteries receive?

14.

1. How could you, with A machine and firing-key, test insulation of cables on board ship?

2. Describe a gravity cell.

3. How can you determine the direction of current flowing in an electro-magnet?

Questions for examination September 2, 1878.

CHEMICAL DEPARTMENT.

1. What is an explosive reaction?
2. Upon what do the force and violence of an explosive reaction depend?
3. Give instances showing the influence of the physical or mechanical condition of a body upon its explosion.
4. What effect has the mode of firing upon the explosion?
5. What is detonation, and how is it produced?
6. General composition of explosive substances.
7. Distinction between explosive compounds and explosive mixtures.
8. Classes of explosive mixtures.
9. Sources and purification of saltpeter for gunpowder.
10. Refining sulphur for gunpowder.
11. Preparation of charcoal for gunpowder.
12. Composition and proportions of gunpowder.
13. Outline of the process of the manufacture of gunpowder.
14. Products of the explosion of gunpowder.
15. Temperature, pressure, and work of the explosion of gunpowder.
16. Influence of the physical and mechanical condition of gunpowder on its explosion.
17. General composition of an explosive compound.

18. Chemical relations of glycerine and nitro-glycerine.
19. Explain the process of making nitro-glycerine.
20. Composition and properties of nitro-glycerine.
21. Mode of firing nitro-glycerine.
22. Comparative force of nitro-glycerine.
23. Products of the explosion of nitro-glycerine.
24. Method of making dynamite.
25. Properties of dynamite.
26. Comparative force of dynamite.
27. Nitro-glycerine preparations other than dynamite.
28. Composition and mode of formation of gun-cotton.
29. Explain method of making long-stapled gun-cotton.
30. Explain method of making Abel's compressed gun-cotton.
31. Properties of and mode of firing gun-cotton.
32. Products of the explosion of gun-cotton.
33. Comparative force of gun-cotton.
34. Composition and chemical relations of picric acid and the picrates.
35. Composition and properties of picric powder.
36. Use of picric powder and advantages claimed for it.
37. Composition and chemical relations of the fulminates.
38. Preparation of fulminating mercury.
39. Properties and uses of fulminating mercury.
40. General composition and properties of the chlorate mixtures.
41. Use of fuse compositions.
42. Method of making liquid carbonic acid and its use as motive power for automatic torpedoes.
43. Compare the different explosive agents for use in torpedoes.

UNITED STATES TORPEDO STATION,
Newport, R. I., September 7, 1878.

SIR: In obedience to the department's order of the 21st ultimo, the board convened on the 2d instant for the purpose of witnessing the examination of the officers under instruction at the torpedo station, and concluded its labors this day. The board takes great pleasure in reporting to the Bureau of Ordnance that it has been particularly and most favorably impressed with the proficiency displayed by the officers under instruction, as well in the practical exercises as in the theoretical course just concluded, and that, so far as can be judged with all the lights available in so short a session, the torpedo station has sustained its honorable and increasing reputation, and deserves the liberal support of the department and of the country.

The board was further impressed by the practical character of the examination itself as a great step in advance of the system pursued some years ago. The board deems the effort on the part of Captain Breese to divest the course of its originally somewhat pedantic character to be a movement in the right direction, as one calculated especially to increase the zeal and attention to study of the older members of such classes as may present themselves or be detailed for instruction, simply because, with men of experience, intelligence, and mature age, application to study is more apt to be induced, if the idea is not constantly presented to their minds that they are, as it were, school-boys in a state of pupilage.

The board would, however, recommend that the term of instruction commence on the 1st of May, instead of in June as now, with a view of

terminating the course before the fashionable world reaches Newport and the gayety of this gay watering-place commences. The full reasons for this recommendation it is not necessary to state, as they are obvious to those familiar with Newport life at this season.

The board deems it but mere justice to state to the Bureau that in its judgment the present officer in charge, Capt. K. R. Breese, is entitled to the greatest praise for the order, neatness, and efficiency which is noticeable in all departments of the station under his command, although he has been somewhat crippled by reason of the small force under his orders, and with a view to increased efficiency it would respectfully recommend that the crew of the Nina be specially augmented to the extent of 25 men.

In conclusion, although not perhaps germane to this report, the board would call the attention of the Navy Department, through the Bureau, to the unusual expense necessarily entailed upon the Inspector of Ordnance in command in entertaining persons of distinction who visit the station (and there are many such attracted by its reputation both at home and abroad), and beg leave to recommend that, if possible, the officer in command of the torpedo station be hereafter allowed the highest pay of his grade with a view of meeting the inevitable and unavoidable demands upon his purse.

All of which is respectfully submitted by

Your obedient servants,

C. H. BALDWIN,
Commodore U. S. N. and President of the Board.
C. H. WELLS,
Captain U. S. N. and Member.
RICHARD W. MEADE,
Commander U. S. N. and Member.
WM. WHITEHEAD,
Commander U. S. N. and Member.

W. N. JEFFERS, U. S. N.,
Chief of the Bureau of Ordnance,
Navy Department, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., September 9, 1878.

COMMODORE: I have to report that the course of instruction closed on Saturday, the 31st August, and that on Monday, the 2d instant, Commodore Baldwin and the officers composing the board of visitors came to the station, were received in the usual manner, and after organizing and inspecting the shops, laboratories, &c., adjourned to meet the next day at 9.30 a. m.

On the morning of the 3d the board were received with a subaqueous salute, and at the library the officers of the class in attendance and under instruction were presented.

The examination then commenced, varying from last year only in its being more thorough.

Questions had been prepared, illustrative of the whole course and sufficient in number to give every officer three, each, in torpedoes, electricity, and chemistry and explosives, as will be seen by the accompanying list of questions.

The list of questions was submitted to the board, and officers were assigned by them to answer.

The thoroughness of the instruction given was indicated, and the aptness of the officers was shown in this examination to be in direct ratio to their note and examination books.

The officers under instruction were required to submit a paper to me on the Offensive use of Torpedoes, and those in attendance were invited to do the same. Commanders Stanton and Carpenter were the only ones of the latter who did so, and their papers are valuable and suggestive.

The papers of the class under instruction on this subject vary in merit, as may be supposed; but as the production of the least meritorious evoked considerable thought and research, good results may be considered to have been attained in each case.

Lieut. D. P. Mannix, of the Marine Corps, with the authority to avail himself of the facilities of the station and the course of instruction in torpedoes, has most assiduously done so, and reflects much credit upon himself and the Marine Corps.

The officers of the station have continued to add to their knowledge and, consequently, their effectiveness as instructors. The Navy should have great reason to be very proud of them. Professor Hill continues his efficient services, every year becoming more and more valuable.

Professor Farmer, the electrician, I regret to say, is still much of an invalid, and, although attending the course of lectures in electricity with much discomfort to himself, beyond a few occasional remarks, he has not been able to lecture or to give much time to station work.

Quite a programme was prepared to give a practical exhibit to the board by all the officers, but the failure of the Tallapoosa to arrive with supplies prevented everything beyond the use of dynamite torpedoes and exercise torpedoes.

Towing the Harvey torpedo against the Joseph Henry was carried out very successfully, and the use of both vessels, as well as the skill of the officers in charge, was well shown.

In conclusion, I wish to say that the class under instruction have been generally very attentive and zealous, and showed great interest in the course.

The commanders in attendance have followed the example of those of last year, evincing the greatest interest and performing everything required of the class, except in submitting their note-books, &c., which was not required.

Respectfully, your obedient servant,

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in Charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., October 29, 1877.

SIR: I submit herewith drawings and explanations of electrical apparata used in connection with appliances fitted to a steam-launch used at this station as an experimental offensive torpedo, which steam-launch and its special fittings have been fully described in drawings and plans previously submitted.

Practical tests have demonstrated that the method of paying out the wire from a tub in which it is coiled in a series of flemish coils, alter-

nating from in and out to out and in, is equal to other methods in efficiency and superior to them in simplicity. The tub fitted with a water-tight cover would keep a coil of wire immersed in water and ready for use in any climate. Experiments have shown that the wire contained in several tubs connected in series will pay out through a central fair-leader quite as readily as from one tub placed directly under the fair-leader. The prolongation of the tiller abaft the rudder, with a fair-leader for keeping the wire clear of the screw, works well in practice. In case the wire coils should all run out it would still be possible by this arrangement to steer the boat when towing the wire, even in a strong tide-way, which would be impossible, or at least very difficult, were the wire held over the stern by a fixed out-rigger. The apparatus for working the links of the engines is precisely similar to that used for moving the tiller, as shown in the detailed drawings submitted in February last, with the exception of the removal of the spring from the "go-ahead" side of the magnet-spindle. The effect of this is to keep the links on that side after they have once been put over, whether the electric current is turned on or off; and to keep them amidships after once being placed there, by sending a current through the "stop" magnet, unless the current should be kept on the latter magnet, in which case the links would be reversed and the engines would back as long as the signal-key were closed. Therefore, when the engines are stopped or going ahead, the full electric current is available for steering or performing any of the other duties assigned to it. For dropping the torpedo-spars just before the attack, I propose to use toggles made of short glass tubes inclosing service-igniters. To drop either torpedo-spar it would be only necessary to turn the current on the igniter, thereby shattering the toggle. Countermines would be dropped in the same manner. The electrical apparatus is equally applicable whether a local battery is used in the boat or all the battery-power is placed at the starting point.

As I hope to show in a short time, it will be easy to arrange an apparatus by which the operator at the starting-point may read the indications of the steam and water gauges and the revolutions made by the engines. A boat of this kind, besides being of use as an offensive torpedo or carrier of countermines, might be of great service to a vessel entering a channel suspected of containing torpedoes, by going ahead with a bight of chain suspended from the ends of a thwart-ship spar and armed with grapnels. The chances would be in favor of not exploding any torpedo that might be caught, until after the chain was partially taut and the launch just out of the dangerous circle. One of the chief merits of this combination of electrical and steam apparata is the ease with which any of the service steam-launches or cutters may be equipped with it without in any way interfering with the performance of their usual duties. It is of comparatively simple construction and does not require any special electrical or mechanical knowledge to enable any one to understand it and keep it in order.

Very respectfully,

T. C. McLEAN,

Lieut. U. S. N., Assistant Inspector of Ordnance.

Capt. K. R. Breese, U. S. N.,

Inspector of Ordnance, in charge of Torpedo Station.

UNITED STATES TORPEDO STATION,
Newport, R. I., October 29, 1877.

SIR: I respectfully submit the following report in regard to the manufacture of, and experiments with, electric igniters and fuses for torpedoes during the year.

The copper case D. E. igniter and the fuse which were approved by the bureau in 1874 have been manufactured for issue to the service, and for experimental work at this station. The results obtained with them have been uniformly good, and no reports have been received of defects due either to original faults in manufacture or to deterioration in those issued to the service.

In August last the supply of bridge-wire, which has been used in making igniters, became exhausted, and a new supply was obtained, which, though intended to be the same, differed somewhat from the old. A comparison of the two wires is given in the following table:

	Material.	Diameter.	Tensile strength.	Resistance, ohms. Cold.	Resistance, ohms. At firing-point of G. C.	Strength of current required to fire G. C.	Length of bridge.
Old wire	2 parts silver .. 1 part platinum	.0025	6 oz	.42	.54	.60, Weber ..	$\frac{3}{16}$ of an inch.
New wire	Same	.0022	10.5 oz ..	.55	.60	.562, Weber...	$\frac{3}{16}$ of an inch.

The new wire has a smaller diameter than the old, which gives it a higher specific resistance, but it has a greater tensile strength, its resistance increases less as its temperature is raised, and less strength of current is required to heat it to the firing-point of gun-cotton. Although its resistance is slightly greater, Professor Farmer recommends retaining the same length of bridge, $\frac{3}{16}$ of an inch, as the small increase in its resistance is of much less consequence than would be the increased difficulty of manufacture should it be shortened sufficiently to get the resistance hitherto used, .42 of an ohm. With this length the resistance of the bridge would be .55 of an ohm, and the igniters can be readily made between the extreme limits of .52 and .58 of an ohm.

The copper cases of igniters, which have been in store for a considerable length of time, have been found to be coated on the inside with sulphide of copper, showing chemical action between the case and the sulphur of the gunpowder filling. Although this action is so slow that none of the igniters examined thus far have been injured by it, it seems advisable to substitute brass for copper as the material for the cases, in order to lessen if not prevent it entirely. The present is a favorable time for making this change, as the brass case will be a good distinguishing mark for igniters made with the new bridge wire.

Two minor changes are proposed in the fuse, viz:

1st. The outer end of the wooden plug is lengthened and scored out for the terminal wires, as shown in Figs. 1 and 2, instead of being cut away to a flat surface. With this form of plug there is less danger of breaking the terminals and also of short-circuiting the fuse.

2d. A rubber cot or sleeve is substituted for the wrapping of greased lamp-wicking as an insulation for the splices between the leading and terminal wires. The cot C and the manner of using it are shown in Figs. 3, 4, and 5. It is a piece of flexible rubber tubing of such a diameter as to be readily slipped on over the fuse A. After splicing the leading

wires it is drawn over the end of the wooden plug B, and secured by a metallic paper-fastener, D, and a seizing, E, Fig. 5.

With these changes the igniter and fuse seem to meet all requirements in a very satisfactory manner.

I am, sir, very respectfully, your obedient servant,

WASHBURN MAYNARD,
Lieutenant and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

Respectfully forwarded and approved to the Chief of Bureau of Ordnance.

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in Charge.

No. 5.—BUREAU OF NAVIGATION.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, October 1, 1878.

SIR: In compliance with your order of the 20th August, I have the honor to submit herewith the estimates of appropriations required for the fiscal year ending June 30, 1880, for this Bureau and the branch of the naval service under its cognizance, and for the support of the Hydrographic Office, the Naval Observatory, and the Nautical Almanac Office.

Very respectfully, your obedient servant,

WM. D. WHITING,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

ANNUAL REPORT OF THE CHIEF OF THE BUREAU OF NAVIGATION, 1878.

NAVY DEPARTMENT, BUREAU OF NAVIGATION,
October 30, 1878.

SIR: I have the honor to submit the following report of the Bureau of Navigation for the past year, together with the estimates for its support, and for the expenditures that will probably be required in that division of the naval service committed to its immediate charge, for the fiscal year ending June 30, 1880. Included in this report, and transmitted herewith, are the reports and estimates of the several offices under its cognizance, and an abstract of offers for supplies received.

NAVIGATION.

The number of Navy compasses has been augmented during the past year by 49 new ones. The style of liquid steering and standard compasses adopted for use on board of all classes of naval vessels is the $7\frac{1}{2}$-inch compass, fitted for receiving the same size azimuth circle. This compass is an excellent instrument and as nearly perfect as it can be made. The supply now available for use is sufficient to meet the probable demands of the service. A number of azimuth circles of an old

pattern have been changed into ektropometers, or dumb compasses, at moderate expense.

My predecessor had taken steps that every station be provided with a complete standard set of instruments for making extended magnetic observations over the whole globe in conformity with the well-digested methods now employed for that purpose. To fit ourselves for the latter, it was found advisable to ask the department to send Prof. B. F. Greene, of the Navy, abroad to examine the methods there in use, who has successfully fulfilled this duty, and whose appended report will not fail to be satisfactory to the Department and to those interested theoretically and practically in the results now attainable, if the requisite appropriations can be had for purchasing the necessary instruments.

As authorized by the Department, the Bureau will provide for one vessel on every foreign station a complete apparatus for taking deep-sea soundings, to be employed when the other purposes of the vessel will permit it and as the commanding officer of the station may direct, or when specially ordered by the Department. The apparatus consists of the machine designed by Sir William Thomson, and modified according to the practical experience of Capt. George E. Belknap, U. S. N., fitted for using pianoforte steel-wire instead of hemp-line, and for obtaining ocean-bottom by the Belknap specimen-cylinders.

The system of taking simultaneous meteorological observations by all naval vessels on the different stations (daily at $0^h\ 43^m$ p. m., Greenwich mean time), inaugurated at the request of the Chief Signal-Officer of the United States Army, is now in successful operation, the necessary instruments, except barometers, having been kindly loaned for the purpose by the Army Signal Office.

HYDROGRAPHY.

The Hydrographic Office is steadily gaining in importance and usefulness by the publication of new charts, sailing directions, notices to mariners, and hydrographic notices, which latter are printed and distributed immediately after the receipt of reports of newly-discovered rocks and other dangers to navigation; of changes in the buoys, beacons, and lights, and whatever other improvements are made which may affect the navigation of the high oceans, as well as the bays and harbors of the world.

I have the pleasure to invite your attention to the report of the Hydrographer, herewith appended, showing in detail the work performed and in progress in the Hydrographic Office.

Although there were no specific appropriations for the purpose, some vessels have been satisfactorily employed, under instructions from the Department, in collecting hydrographic information, without detracting much from their usefulness as cruisers.

The United States steamer Essex, Commander W. S. Schley, has made lines of deep-sea soundings across the Atlantic Ocean from Cape Henry to San Paul de Loando, and thence to Cape Frio, Brazil; and this vessel is now under orders to sound off the mouth of the La Plata River.

The United States steamer Adams, Commander Frederick Rodgers, discovered the Rodgers Bank, and examined the Hotspur Bank off the coast of Brazil.

The United States steamer Tuscarora, Commander J. W. Philip, has been sounding off the coast of Lower California, and surveying the Tartar Shoal and part of the coast of Mexico.

The United States steamer Gettysburg, Lieut. Commander H. H. Gorringe, is still employed in collecting data for sailing directions for the Mediterranean, two volumes of which have already been issued.

The United States steamer Guard, Lieut. Commander F. M. Green, has established, by means of electric telegraph signals, the difference of longitude between Lisbon, Madeira, Cape de Verdes, and Pernambuco, and has measured the difference in longitude between Rio de Janeiro, Montevideo, and Buenos Ayres. The cable between Pernambuco, Bahia, and Rio de Janeiro being unfortunately broken, that measurement could not be made at present, and the vessel is now on her way back to the United States.

The United States steamer Alaska, Capt. George Brown, has taken a number of deep-sea soundings in the vicinity of a reported rock, in latitude 25° 34′ north, longitude 41° 23′ west, finding not less than 2,105 fathoms, thereby disproving the existence of a rock in the said locality.

The United States steamer Enterprise, Commander T. O. Selfridge, has been employed, under your orders, in surveying the Amazon and Madeira Rivers, in order to establish their channels and limits of navigability, which work has been satisfactorily completed, after an absence of the vessel of five months.

The United States steamer Swatara, Commander Montgomery Sicard, has done some valuable work of sounding and surveying in the harbor Vera Cruz, Mexico.

The United States steamer Ashuelot, Commander G. H. Perkins, determined the positions of the Meac-Sima Group and Vincennes Rocks, south of Japan.

I fully concur in the recommendations made by my predecessor in several annual reports, that an extensive survey of the many islands, rocks, and shoals in the Pacific Ocean be entered into by the Navy, in order to lessen the dangers of navigating that ocean. As long as the proposed survey is delayed, we may expect disasters and loss of life and of property manifold beyond the cost of making the survey.

I also renew a recommendation, made last year, that the surveys of the Ishmus of Panama and the Atrato-Napipi routes, made by United States naval officers under the command of Commander E. P. Lull and Lieut. F. Collins, respectively, be published. While the interest in the projected interoceanic ship-canal across the American isthmus is on the increase both in America and Europe, it would seem but proper that the surveys of the different routes be made accessible to all concerned in the project. The United States Navy has accomplished the laborious task of surveying a number of proposed routes, and of the several surveys made those across the Isthmus of Panama and of the Atrato-Napipi line remain as yet unpublished.

SIGNALS.

The report of the Chief Signal Officer of the Navy, to which I beg leave to refer, treats of the various experiments made during the past year with new methods of signaling.

The method of night-signaling by means of colored stars projected from a pistol, invented by Lieut. E. W. Very, U. S. N., has recently been introduced into the service, and most vessels are now fitted with the necessary implements. The said officer has since submitted a new plan of a complete system of night-signaling, which promises increased usefulness, as it can be applied to intercommunication between United States naval vessels by means of the Naval Signal Code, and also between vessels of

different nationalities by the use of the International Signal Code. A system of night-signaling by means of the latter code would supply a long-felt want, and for that reason, and on account of its simplicity, the system proposed by Lieut. E. W. Very demands attention. It will be thoroughly examined.

With the "Evanswood signal lamp," designed by Lieut. Commander R. D. Evans and Lieut. W. M. Wood, U. S. N., colored flash-signals have been made at Fort Whipple, near Washington, which were distinctly understood at a distance of 16.9 miles. Further trials at Newport, R. I., under various circumstances of weather, have proved this lamp a valuable means for night-signaling, either by the Army method or Very's system of two color combinations.

Experiments have also been made on board the United States steamer Hartford, flagship of the South Atlantic station, in signaling by means of flashes produced by an electric-light machine, and although these trials were not quite satisfactory, there is no doubt that electricity will sooner or later be an important element in signaling.

Thus it will be seen that, although there is in time of peace no immediate want of improved signal methods, the bureau is preparing, in an economical manner, for contingencies demanding the readiest and surest methods.

NAVAL OBSERVATORY.

The report of the Superintendent of the Naval Observatory, herewith appended, is entitled to special attention, as it contains the details of highly useful and interesting astronomical work performed during the past year, notably the observations of the transit of Mercury, May 6, 1878, and the solar eclipse, July 29, 1878.

NAUTICAL ALMANAC.

The report of the Superintendent of the Nautical Almanac, besides stating the work performed in the office in the preparation of the American Ephemeris and Nautical Almanac, in advance, treats of the changes inaugurated under the advice of the National Academy of Sciences, to which, in December last, you referred the question as to what changes were required in the Ephemeris to make it more serviceable to those who use it. The improvements in question will commence with the volume for 1882, already in the hands of the printer.

Respectfully submitted.

WM. D. WHITING,
Chief of Bureau.

HON. R. W. THOMPSON,
Secretary of the Navy.

OFFICE OF THE SUPERINTENDENT OF COMPASSES,
BUREAU OF NAVIGATION,
Washington, October 26, 1878.

SIR: I have the honor to submit the following report for the current year:

NAVY COMPASSES AND COMPASS INSPECTION.

I have nothing but the usual routine duty to report relative to the Navy compass, with the exception of a noteworthy occurrence in connection with the last lot of compasses inspected by me in September.

This was the discovery of an error varying from 0°.5 to 1°.5 in twenty-five of these compasses, arising from magnetism of the compass-bowls. The discovery of this condition was made by Mr. E. S. Ritchie, in the course of his observations for the verification of the card adjustments and the centering of the pivots; and he had applied the only practicable remedy, although at considerable expense to him, by the substitution of new bowls before my arrival for the duty of inspection. Such an accident, though once reported in the experience of the British Admiralty, is probably of rare occurrence. At the least, it appears to have been rarely observed; but without the appliances of a compass observatory, or of equivalent observations, it would probably escape recognition, unless specially sought for, when it might be easily detected by simple tests of the bowls. Some of the defective bowls in this case have been preserved for future examination as to the causes of the magnetism.

COMPASS DEVIATIONS AND THE MAGNETISM OF SHIPS.

Under this head I have nothing special to report, inasmuch as the iron ships of the Navy which are not laid up have been on special service or otherwise on foreign stations during the past year.

MAGNETIC SURVEYS.

In obedience to instructions from the department in special orders of the 11th of March last, I proceeded to England in the following month, to obtain such information as might be available concerning the practical administration of the system of magnetic observations in the British navy, in order that we might profit by their experience in any attempt to establish similar observations (as suggested in the report of the bureau for 1877) in the naval service of the United States. In submitting a brief generalized statement of the results of this inquiry, in addition to the several special reports already made to the bureau, I beg to present it under certain heads, as follows:

1. *Distribution of the service of magnetic surveys in the British navy.*—The administration of magnetic surveying, like that of hydrographic surveying, and other allied objects of the home service, is under the immediate charge of the Hydrographic Office; which, as is well known, holds somewhat the same relations to the general administration of the British Admiralty as the Bureau of Navigation does to the Navy Department of the United States.

For many years past it has been usual to have several ships of the navy fitted with instruments and the necessary appliances for magnetic surveying in different parts of the globe. Sometimes these outfits were associated with outfits for hydrographic surveying; and sometimes they have been placed on board ships detached for special service; the object being to provide the requisite facilities for doing a certain amount of systematic work of this kind in those parts of the globe where it appeared to be most needed. The occasional special expeditions for general discovery and research have usually been provided with the means for conducting magnetic observations in addition to their other duties. In all cases, where magnetic observations have been provided for, they have been regarded as properly comprising the measurements of the several magnetic elements of the earth.

2. *The system of magnetic observations actually conducted.*—It has therefore been the object of the magnetic service of the British navy to obtain the requisite data for the determination of the magnetic variation, the

magnetic dip, and the total magnetic force; the first two elements defining the direction and the third the intensity of the terrestrial magnetic force for each position occupied upon the surface of the earth, and for the date at which the observation is made. For convenience, the observations of these data are comprised in two distinct classes; namely, those made on board ship at sea, and those made on shore at different stations of call, including the primary station at or near the port of outfit. The land stations serving as terminal or base stations for the different tracks upon which the observations are made at convenient intervals for determined positions of the ship, the different series of observations come in to definite relations of position with each other. The observations on shore are expected to furnish absolute determinations of the magnetic elements in the units of weight and measure employed; and being made under circumstances favorable to the use of the requisite instruments, the results are expected to have all the precision which the skill and care of the observer may enable him to attain. At sea, however, the circumstances of the observation not permitting the use of such methods, the determinations are necessarily relative rather than absolute; but the instruments employed and the methods of observation adopted are expected to furnish results on each track of the ship, which, by means of the known instrumental constants and other ascertainable corrections, may be brought into such relations to the absolute determinations at the base stations of the track as to admit of being reduced to absolute determinations with, in general, a satisfactory degree of precision.

On shore, the elements observed are the variation, the dip, and the horizontal force; at sea, the observations are directed to the variation, the dip, and the total force. Of the observations at sea, the results are subject especially to errors of deviation from the magnetism of the ship's iron, the elements of which must be determined in the usual manner, and the corrections therefrom deduced and applied to the magnetic observations on board.

3. *Instruments used in these observations.*—The instruments latterly used by the British navy in magnetic surveys are as follows:

First, for absolute determinations on shore.—For the magnetic variation an azimuth compass of the ordinary (or standard) Admiralty type is generally used; for the magnetic dip, a six-inch dip circle of the Kew pattern; and for the horizontal force, a unifilar magnetometer of the Kew form. In occasional instances a special declinometer, as an appendage to the unifilar magnetometer, is supplied to a ship for more refined measurements of the variation; and, in general, the dip-circle is provided with weights and deflecting magnets for the use of Dr. Lloyd's method for the statical determination of the total force. The tripod support for portable use of the unifilar is alike adapted to the use of the dip-circle, so that no other support is required for field use with either instrument. The ordinary tripod for portable use of the compass is also the support for this instrument in these observations.

Secondly, for relative determinations on board.—For the magnetic variation, the azimuth compass is of course the only instrument that can be used; for the magnetic dip, a Fox's dip-circle is used, and for the total force the last-named instrument is also used, with the provision of weights and deflectors, after the method of Dr. Lloyd for this element. The support of the compass in this case is its usual pillar or standard fixed upon the deck. The Fox's circle is, however, provided with a special table support in a fixed position on deck, having gimbaled bearings for universal motion, with a low center of gravity for sufficient

stability, and a hood for the protection of the instrument against the weather.

It is thus seen that, with the exception of the azimuth compass, which is always included in the navigation outfit, the only instruments actually required in the outfit of a ship for magnetic surveys, in providing for both land and sea observations, are three in number; that is to say, one six-inch dip-circle, one Fox's dip-circle, one unifilar magnetometer, with the portable tripod for the common use of all three on the land, and the gimbaled table for the second fixed on the deck of the ship. As to the use of a special declinometer for land observations of the variation, it would seem to depend partly on the character of the survey and partly also on the disposition of the officer charged with the observations. Unless sufficient deliberation and care can be generally had to realize the full advantage in point of precision to be expected from the use of this instrument, experience has shown that it is more judicious to avoid the incumbrance of the additional apparatus, as well as the labor of the greater refinement of observation, and rely wholly on a good azimuth compass for the variation on both land and sea. It is well known that, with the compass in good adjustment, and with intelligence and care in the observation, quite satisfactory results may be obtained in this manner, entirely reliable within certain limits of error, such as in general may be admitted in extensive magnetic surveys of the kind here considered. The instruments here mentioned as used in the British navy are now and have been from the first of English make.

There is little question that the leading position occupied by Great Britain in practical magnetics for many years past (which is pretty generally acknowledged elsewhere), has led to a corresponding superiority in the construction of instruments for the measurement of the terrestrial magnetic elements. The fact would seem to be sufficiently established by the demand for these instruments, as noted in another part of this report.

The somewhat invidious question of who among the well-known English artists may be regarded as the best or most reliable makers of these instruments is one that would probably have received somewhat different answers at different times during the past twenty years; and it is quite possible that the answer would not have been always the same by different persons at the same time. At present, however, I became quite well satisfied, as the result of my inquiries in this direction, that great confidence may be had in the excellence of the dip-circles made by Mr. John Dover, of Charlton, in Kent County, near London, and in the goodness of the unifilar magnetometer made by Messrs. Elliot & Brothers, of London. As to the azimuth compass, we have no occasion to seek this instrument abroad.

4. *Determination of instrumental constants.*—Next in importance to the possession of suitable and well-made instruments for these observations is the accurate determination of certain specific constants of the instruments, which are essential to their reliable use at different places and dates and under different physical circumstances. These can only be conveniently determined at a magnetic observatory, or at the least at a place where the physical surroundings are favorable and suitable instruments available for the requisite magnetic investigations. These important determinations for the magnetic instruments of the British navy, with the exception of the azimuth compasses, are made at the Kew Observatory, which is located upon the grounds of the Old Deer Park in Richmond, near London, and is therefore conveniently accessible for the purpose from the Admiralty offices. The Kew establishment is a physical

observatory, devoted mainly to magnetism and meteorology; and its magnetic department for many years has not only represented the best knowledge of instruments and methods in practical magnetics for Great Britain, but this supremacy appears to be acknowledged elsewhere, at least over the continent of Europe. Indeed, the Kew forms of magnetic instruments, as made by English artists, have been supplied through the Kew Observatory, after being verified and their constants determined at that establishment, to the governments, scientific institutions, and to private magneticians of nearly all the European states.

5. *Preliminary instruction of officers.*—It might be supposed that officers of the Navy who had once been instructed, and had, besides, subsequently gone through a considerable experience in magnetic observations, should be capable and sufficient instructors of others; nevertheless, it would appear that, in the absence of any suitable place and appliances for this kind of instruction, regarded as a naval establishment, officers of the British navy, who have been detailed for the duties of magnetic observers, have frequently been in the practice of visiting the Kew Observatory for their preliminary instruction in those duties. In reality there are certain advantages in having this instruction given at a magnetic observatory, where, with the superior resources of such an establishment, the instruction may be based on the latest and best experience, not only in the detailed procedure of an observation, but in the proper handling and care of instruments; the lessons in the teaching of the latter being of high importance in this kind of work, especially as done by the navy, and nowhere better understood than in an observatory which is constantly striving for the highest excellence in its results.

In connection with the preliminary instruction of the naval observers, it has been usual for the officers charged with these duties to make the primary observations with the instruments intended for their use at the Kew Observatory, regarded as a primary base, before embarking.

6. *The results of naval magnetic surveys.*—The immediate results of the magnetic observations, being recorded as they are made upon conveniently-arranged printed forms, are sent forward from time to time (but as frequently as practicable) to the admiralty, where, after a careful scrutiny in the hydrographic office, they are laid away among its archives for future reductions. These are not usually made until the surveys of any particular ship shall have been completed, the instruments returned, and suitable final observations made at the primary base, which, as before remarked, has usually been the Kew Observatory. With the final reductions of the observations, the part undertaken by the navy in this work is considered to have been completed. After this, the results are left to the general discussions of the magnetician.

I also proceeded to Paris, in accordance with my instructions, and visited the depot of charts and plans (in the department of the marine), having in charge the magnetic work of the French navy. I found, however, nothing of recent additions to their well-known methods of former years to lead me to doubt the present superiority of the English instruments and methods in nautical magnetics, whether for observations on land or on board ship.

In concluding my report of this visit abroad, I beg to express my grateful acknowledgments to Capt. Frederick John Evans, R. N., Hydrographer of the Admiralty, and Mr. G. M. Whipple, Superintendent of the Kew Observatory, for their many courtesies and kind personal attentions, through whom the objects of my visit were greatly facilitated. And I also beg to record my acknowledgments for the courtesies received, on

my visit to the French hydrographic department, from Messrs. Gaussin and Ploix, hydrographic engineers of the French navy, attached to that department.

I am, sir, very respectfully, your obedient servant,

B. F. GREENE.

Professor Mathematics, U. S. N., Superintendent of Compasses.

Commodore WILLIAM D. WHITING, U. S. N.,

Chief of Bureau of Navigation, Navy Department.

HYDROGRAPHIC OFFICE, BUREAU OF NAVIGATION,

September 14, 1878.

SIR: In accordance with the bureau's instructions, I have the honor to submit the estimates of this office for the fiscal year ending June 30, 1880.

During the fiscal year ending June 30, 1878, the following work has been done in the drafting and engraving department:

1.—WORK LEFT UNFINISHED IN THE PREVIOUS FISCAL YEAR.

The engraving of the new edition of the general chart of the North Pacific Ocean in four sheets was finished and numerous new additions made from late surveys.

Of the general chart of the South Pacific Ocean in eight half-sheets, the engraving of the two western half-sheets was finished.

Of the Mediterranean charts in three sheets, the western sheet was finished and corrected from late surveys.

The engraving of the middle sheet was carried on as far as the data at hand permitted.

The eastern sheet was prepared for engraving, and a sketch of the entire Mediterranean engraved on the plate.

The engraving of the English and Irish Channel charts, each in two sheets, as also of four harbor charts, was completed.

2.—NEW WORK COMPLETED DURING THE YEAR.

Fifteen new coast and harbor charts were prepared and engraved. The greater number of these are from the surveys by the United States steamer Narragansett in the Gulf of California, and on the west coast of Mexico.

Fifteen new charts were photolithographed—three of them from data furnished by the United States steamer Gettysburg.

Five new charts were autographed—one of them from an examination by the United States steamer Alert.

On thirty plates more or less extensive additions and corrections were made from new surveys, and on almost all the plates minor corrections, such as changes in lights, buoys, &c.

3.—WORK ENTERED UPON AND STILL IN PROGRESS.

The six remaining half-sheets of the general charts of the South Pacific Ocean were prepared for engraving, and the engraving contracted for outside of the office, except the last sheet.

Charts of the Indian Ocean, in four sheets, and of the North Atlantic

Ocean, in two half-sheets, are under preparation, and the engraving has also been contracted for outside of the office.

Four thousand five hundred and forty-five charts and nine hundred and seventeen books, publications of this office, have been sold to its agents for the demands of commerce, in addition to those furnished to vessels of the Navy and our exchanges with foreign offices.

Hydrographic notices and notices to mariners have, as information has been received, been published and distributed.

Volume I of the Navigation of the Caribbean Sea, Gulf of Mexico, Bahama Banks, and West India and Bermuda Islands; Volume III of the West Coast of Africa; Part II of the English Channel; the report of the telegraphic determination of longitudes in the West Indies and Central America, and Part II, Coasts and Islands of the Mediterranean Sea, have been printed and issued.

In the meteorological department of this office an atlas of meteorological charts, which were compiled with great care and ability by Lieut. T. A. Lyons, U. S. N., has been published and issued. These charts comprise an area of the ocean extending from the equator to 45° north latitude, and from the coast of America to 180° of west longitude. This area is divided into squares of 5° each, which are numbered so that at a glance the navigator can discover the direction, force, and percentage of the winds he may expect, the mean barometric pressure, the mean temperature, and indeed a mass of condensed and useful information in any given square. It is proposed to continue this work until the whole surface of the navigable ocean is completed.

Efforts are being made to interest the merchant marine in these useful compilations, and the ready manner in which those who have been consulted respond induces the hope that they will be successful.

The Gettysburg, Lieutenant-Commander Gorringe, U. S. N., has been employed in collecting material for compiling sailing-directions for the Mediterranean, two volumes of which have been published and issued. During the progress of her work her machinery became disabled, and it was necessarily discontinued; it is to be hoped that she or some other vessel may be able to complete the little which yet remains to be done.

The Guard, Lieut. Commander F. M. Green, U. S. N., is still employed determining longitudes by electric cable. The work which he was directed to accomplish is so nearly completed, that it is not thought that any further appropriation for this purpose will be required.

The Tuscarora, Commander Philip, U. S. N., has been employed on offshore soundings on the coast of Lower California, has made a survey of the Tartar Shoal, and has been engaged in surveying on the coast of Mexico; her work has been necessarily discontinued, but it is hoped it will be resumed during the coming autumn and winter.

The Adams, Commander Frederick Rodgers, U. S. N., discovered the Rodgers Bank and examined the Hotspur Bank off the coast of Brazil.

The importance of the survey of the Pacific Ocean cannot be overestimated in view of the numerous islands, rocks, and shoals now on the charts whose existence and positions are doubtful.

An exhaustive work of this kind in the Pacific Ocean would be of the greatest assistance to navigators, and I cannot too strongly urge that some steps may be taken for its accomplishment.

Respectfully, your obedient servant,

S. R. FRANKLIN, *Captain U. S. N.*,
Hydrographer to the Bureau.

Commodore WILLIAM D. WHITING,
Chief of Bureau of Navigation.

NAVY DEPARTMENT,
BUREAU OF NAVIGATION, SIGNAL OFFICE,
Washington, October 28, 1878.

SIR: I have the honor to submit the following report of the operations of this office during the past year:

Experiments have been carried on with the Very night signal, and it has been found that the composition of the stars and the present mode of manufacturing them answers every purpose, and that they improve with age. In the bureau's circular of October 10, 1877, adopting this system for use in the Navy, officers were invited to forward plans either for the improvement of the signal or method of applying it, objections having been made to the chronosemic feature of the system as now used. Plans of improvement have been submitted by Lieuts. E. W. Very, W. H. Turner, and John H. Moore, which have only been partially experimented with, owing to the smallness of the appropriation for signals.

The use of the Very night signal having been limited to the tactical and general signal books, Lieut. W. M. Wood, U. S. N., has invented an ingenious flash lamp for communicating by the Telegraphic Dictionary and Geographical List, or by the General Service Code by means of magnesium mixed with either strontia or baryta, which gives a red or a green flash.

Most satisfactory experiments have been made with this lamp by the Army Signal Office and by a board of officers aboard the United States steamer Saratoga, confirming the favorable results obtained, from limited experiments, by this office. Signals have been sent and read with the naked eye, without difficulty, at a distance of 16.9 miles during a severe rain-storm with high wind. It has also been used in a heavy fog, at short distances, with very good results.

I would respectfully recommend that a few of these lamps be issued to the service.

During the year careful supervision has been exercised over the signal department of the various vessels in the service, and I am gratified to be able to state that, judging from the quarterly reports of signals received at this office, we have not a vessel in commission aboard of which there is not a number of trained signalmen.

I am, sir, very respectfully, your obedient servant,

J. C. BEAUMONT,
Commodore, and Chief Signal-Officer, U. S. N.

Commodore WM. D. WHITING, U. S. N.,
Chief of Bureau of Navigation.

UNITED STATES NAVAL OBSERVATORY,
Washington, October 29, 1878.

SIR: In compliance with the order of the Bureau of the 23d instant, I have the honor to submit a report of the operations of the Naval Observatory during the past year.

THE 26-INCH EQUATORIAL.

This instument has been in charge of Prof. Asaph Hall, with Prof. Edward S. Holden as assistant. Mr. George Anderson is employed as an assistant in the dome.

The instrument is constantly employed in observing satellites, double stars, nebulæ, and a few comets.

As the lenses showed some particles of matter collected on their inner surfaces, they were taken apart and cleaned by Mr. A. G. Clark, on October 3, 1878. The instrument is now in good working order.

The transit of Mercury, May 6, 1878, and the solar eclipse of July 29, 1878, attracted many foreign astronomers to this country, and some of them having seen our large equatorial, it is worth while to note their criticisms of this instrument. While all speak highly of its optical performance, many of these astronomers, especially the English, think the mounting too light for so heavy an instrument. There is, no doubt, a degree of truth in this criticism, and the instrument appears subject to tremors in right ascension which a heavier mounting might remedy. And yet it is remarkable that during the five years that this instrument has been mounted, observations show that the position of the pole of the instrument has changed only a fraction of a minute of arc.

The following table gives the exact data:

Position of the pole of the instrument.

Date.	η	ξ	Observers.
	′	′	
December 18, 1873	—2.5*	—1.10*	N. & Hn.
December 13, 1876	+0.28	—1.60	H. & Hn.
January 9, 1877	+0.27	—1.61	H. & Hn.
January 3, 1878	+0.47	—1.34	H. & Hn.

* After this determination and before the succeeding one the telescope was partially dismounted.

The driving-clock is now in good order, and performs well.

The dome, probably on account of the decay of some of the lower timbers, has got out of round and is moved with difficulty. The moving of the dome had become so difficult, that some repairs were made during the absence of the observers on the solar-eclipse expedition. These repairs have made the moving easier, but the turning of this large and heavy dome may become a serious difficulty after a few years. It will cause an annual expense to keep this dome in working order.

The work done during the past year by the astronomers on this instrument is as follows:

Professor Hall observed the satellites of Saturn until January 5, 1878, when the position of the planet had become so near the sun that observations were given up. These observations are mostly those of Japetus, Titan, and Hyperion, the faintest of these satellites. The inner satellites were observed only a few times, since they are now regularly observed at several observatories. The appearance of the ring of Saturn was carefully noted during the whole opposition, and it was followed until February 11, 1878. The disappearance of the ring occurred February 6. The angle of position of the major axis of the ring was observed on thirty-six nights by Professor Hall and on twenty nights by Professor Holden. Although at the time of the disappearance of the ring the planet was too near the sun for good observations, yet the whole of these observations indicate that Bessel's elements of the ring are very nearly correct.

The planet Venus was observed by Professors Hall and Holden from October, 1877, until March, 1878. Several drawings of the planet were made by Professor Holden. No spot was found on the planet that could be observed for determining its time of rotation. The appearance of the disk of the planet, its shading towards the terminator, and the

irregularity of the edge of the terminator was the same as has been observed before. No satellite of this planet was seen.

The satellites of Mars were observed by Professor Hall until October 31, 1877. The calculation of the orbits of these satellites from the observations made at Washington, and the reduction and comparison of all the observations made in 1877, were undertaken by Professor Hall in November, 1877, and the work was finished in May, 1878. A report on this subject was published in September, 1878.

The satellites of Uranus and Neptune were observed by Professor Holden, who also made some observations of the inner satellites of Saturn and of the satellites of Mars.

Observations of the double stars selected by Mr. Otto Struve, director of the Imperial Observatory at Pulkowa, for determining the personal errors of various astronomers, have been made by Professor Hall. This list contains thirty stars, and on an average each star has been observed six nights. These observations may be sufficient for the purpose intended, but a few more observations of the closer pairs seem necessary in order to determine the errors in the angles of position which depend on the hour angle at which the observation is made. To complete this work Professor Hall has observed the six stars in the trapezium of Orion, the different combinations of the angles and distances of these stars being measured first with bright wires in a dark field, and again with dark wires in a bright field. Each angle and distance has been measured six times by each method. Professor Holden has made a discussion and an adjustment of these measurements by the method of least squares.

Some of the more interesting and difficult of the binary stars have been observed by Professor Hall; and a good series of observations of the companion of Sirius has been made by both Professors Hall and Holden. The observations on this companion should be continued, and it is hoped they will contribute towards deciding the interesting question whether the Clark companion really produces the variable proper motion of Sirius.

Professor Holden has observed the nebula of Orion on twenty-eight nights. He has made a determination of the relative brightness of the different parts of this interesting nebula, and for this purpose has used a photometer devised by Dr. Hastings, of the Johns Hopkins University. These photometric determinations show that this instrument is capable of giving excellent results.

Besides his work on this nebula, Professor Holden has observed six other of the more interesting nebulæ, and has also devoted some time to the observations of the stars connected with these nebulæ.

Early in July, Temple's periodical comet was looked for on several nights by Professor Holden, and on one night by Professor Hall. Unfortunately, the errors of the ephemeris were much greater than they were supposed to be, and the comet was not found.

A very careful and exact determination of the value of one revolution of the micrometer-screw has been made by Professor Holden. During the past year this value has been determined by observing the difference of declination of two known stars by means of intermediate stars. The result shows that our adopted value is essentially correct. This value is: One revolution = 9''.948.

Besides making the regular observations on this instrument, the pro fessors attached to it have taken part in special observations.

THE TRANSIT CIRCLE.

This instrument, under the direction of Prof. J. R. Eastman, assisted by Assistant Astronomer Edgar Frisby (appointed professor June 11,

1878), Assistant Astronomers A. N. Skinner and H. M. Paul, and Mr. H. S. Pritchett (appointed assistant astronomer September 18, 1878), has been employed in observations of—

1. Stars of the American ephemeris for clock and instrumental corrections.
2. Sun, moon, major and minor planets.
3. Stars whose occultations were observed in connection with observations of the transit of Venus in 1874.
4. Standard stars for a catalogue of zone observations.
5. Stars of the British Association Catalogue between 120° 0′ and 131° 10′ N. P. D.
6. Stars employed in observations of comets with the 26-inch and 9.6-inch equatorials.
7. Stars used by Mr. David Gill, of the Royal Astronomical Society of London, in his work of determining the solar parallax from observations of Mars with the heliometer.

The number of observations made with the transit circle during the year is 3,450.

The sun was observed 61 times; the moon 60 times; and there were made 110 observations of the major planets and 149 of the minor planets.

The readings for determining the errors of the divisions on the limb of circle B of the transit circle have been continued the past year, and the data for determining the errors of the single degree divisions were completed during the present month. The computations will be made as soon as practicable.

The annual volume for 1875 has been greatly delayed by lack of funds for printing. The transit-circle work for 1876 is nearly ready for the press. The transit-circle work for 1877 is more than half finished, and the reduction of the observations of 1878 has been commenced.

THE 9.6-INCH EQUATORIAL.

This instrument is under the charge of Professor Eastman, who has the same assistants as on the work with the transit circle. It has been employed in the observation of occultations, and in determining the approximate corrections to the ephemerides of such small planets as are not readily found with the transit circle.

The meteorological department is under the charge of Professor Eastman, and the usual observations have been made at intervals of three hours, beginning at midnight, throughout the year. The observations and the records are made by the watchmen, Messrs. Hays, Horigan, and Cahill.

The control of the system of wires within the observatory connecting the various clocks, chronographs, &c., and of the connections with the wires of the Western Union Telegraph Company, is, as heretofore, in the hands of the officer in charge of the transit circle, while the immediate charge of all the batteries, wires, and their connections, is confided to Mr. W. F. Gardner, the instrument-maker. The connections within the buildings remain nearly the same as during the past year.

Beyond the observatory, this department is responsible for the control, by means of the motor clock, of several clocks in the State, War, Navy, and Treasury Departments; for furnishing accurate time-signals to the Western Union Telegraph Company, and for dropping the time-ball on the Western Union Telegraph office in New York.

A thorough change in the method of controlling these clocks is required, and a proper and creditable distribution of time-signals will

require the use of another clock, and a change in the present method of sending the signals. These changes will cost about $500, which sum is asked for in the estimates.

TRANSIT OF VENUS.

In reducing the transit of Venus photographs, it became evident that the shrinkage of the collodion was of such a character as to be almost a vanishing quantity, and that it would be advantageous to combine the correction for it with the correction for the interval which existed, when the picture was taken, between the reticule and the sensitive surface of the collodion. With this view, Prof. William Harkness has measured upon each of the two hundred and twenty-one photographs, the interval between the impressions of two of the vertical lines of the reticule, and also the interval between the impressions of two of the horizontal lines of the reticule; these intervals being in every case taken as great as possible. The intervals between the lines upon each of the eight reticules themselves, was subsequently measured with such a degree of accuracy that their probable errors did not exceed the twenty-five thousandth part of an inch; and from these data the desired combined corrections were readily computed.

The work of reducing the observations for the chronometrical longitudes of the stations on Kerguelen Island, New Zealand, Chatham Island, and the German station on Aukland Island, is now almost completed. The chronometers employed varied in number, at different times, from twenty-three to thirty-five; and as their errors had to be computed for every day they were in use, from August 6, 1874, to January 30, 1875, the operation proved to be rather tedious. It was executed under the direction of Professor Harkness, assisted at first by Mr. Josef Lyons, and subsequently by Mr. H. S. Pritchett.

TRANSIT OF MERCURY, MAY 6, 1878.

The transit of Mercury was observed by Professor Hall at Washington. Seventy-two photographs of the planet when on the disk of the sun were made at Washington, by Mr. Joseph A. Rogers, with one of the photo-heliographs used in photographing the transit of Venus in December, 1874. A report on this transit, the adjustments of the photo-heliograph, &c., has been made by Professor Hall.

Professor Harkness, with Lieut. G. E. Ide as assistant, was sent to Austin, Texas, to observe this transit. He occupied the old Coast Survey station in the grounds of the Texas land-office, and although the first half of the transit was lost in clouds, he was favored with a clear sky and a steady atmosphere during the latter half, and succeeded in making twenty-five measures of the polar diameter of Mercury, the same number of measures of its equatorial diameter, excellent determinations of the instants of the third and fourth contacts, and a very satisfactory observation of the physical phenomena attending these contacts. The instrument employed was one of the transit of Venus 5-inch equatorial telescopes, armed with an Airy double-image micrometer. The necessary knowledge of the local time was obtained from observations made with a sextant and mercurial artificial horizon.

The transit was observed by Professor Eastman with the 9.6-inch equatorial at the observatory; and by Assistant Astronomers Frisby and Skinner, with smaller equatorials.

Professor Eastman observed the second, third, and fourth contacts,

made several series of measures of the diameter of Mercury, and made a careful study of the physical phenomena at the time of contacts. Messrs. Frisby and Skinner observed contacts.

Professor Holden, in connection with Dr. Draper, at Hastings-on-the-Hudson, observed the third and fourth contacts, and secured 19 good photographs.

Assistant Astronomer H. M. Paul observed the transit at Hanover, N. H.

Prof. James C. Watson, director of the observatory at Ann Arbor, Mich., and Prof. E. C. Pickering, director of Harvard College Observatory, Cambridge, Mass., kindly agreed to photograph the transit if suitable instruments were furnished them; and, accordingly, two of the horizontal photo-heliographs which had been used for the transit of Venus, and six dozen sensitive dry plates, were sent to each of them. Professor Watson exposed all his plates, but owing to bad weather Professor Pickering exposed successfully only twenty-six of his. As soon after the transit as possible, the plates were returned to the Naval Observatory and there developed by Mr. Joseph A. Rogers, who had originally prepared them, the resulting negatives being quite satisfactory. The measurement of these photographs, and their reduction and discussion, have been assigned to Professor Harkness.

The compilation and discussion of the telescopic observations of the transit of Mercury, made in various parts of the country and forwarded to this observatory, is under the charge of Professor Eastman, assisted by Mr. Paul, and will soon be ready for publication.

TOTAL SOLAR ECLIPSE OF JULY 29, 1878.

As this was the last solar eclipse which would be visible under favorable conditions in the United States during the present century, it was deemed very important to have it thoroughly observed; and it was thought that nothing would contribute more to this end than the diffusion of accurate knowledge concerning the objects and methods of observation. With this view, Professor Harkness was directed to draw up detailed instructions to observers, which were subsequently published in the form of a quarto pamphlet of thirty pages, and widely distributed among those who seemed likely to take an interest in the matter.

The investigations made while drawing up these instructions led Professor Harkness to conclude that, in order to obtain thoroughly satisfactory photographs of the corona, it would be necessary to use far more powerful apparatus than had been employed heretofore, and he proposed the construction of two equatorial cameras of six inches aperture and thirty-six inches focus. After due consideration this plan was adopted, the objectives being furnished by Dallmeyer, of London, the camera tubes with their finders by Stackpole & Brother, of New York, and the plate-holders, both wet and dry, by the American Optical Company, of New York.

As there was neither time nor money for the construction of equatorial stands and clock-work, two of the transit of Venus 5-inch telescopes were removed from their equatorial mountings, and the cameras were substituted in their places. In this way two very serviceable instruments were obtained, which were subsequently used by the parties of Professors Hall and Harkness. At first it was intended to employ wet collodion plates, but against this plan almost insuperable difficulties opposed themselves, and it was finally decided to adopt dry plates, if suitable ones could be had. At this juncture Mr. Joseph A. Rogers,

formerly connected with this observatory, kindly offered to give us some dry plates of his own manufacture. A few experiments showed that they were perfectly reliable, and quite as sensitive as wet plates; and the results subsequently obtained with them upon the corona prove that there is every reason to be thankful that we accepted his generous offer.

As the liberal appropriation made by Congress enabled the observatory to fit out quite a number of parties, the co-operation of all the best-known astronomers in the country was solicited, and they responded heartily. While the observatory was able to assist them, both pecuniarily and by the loan of instruments, it should be understood that they were left entirely free to plan their own observations, thus securing a wide range of investigation. The final arrangement of the parties and the work accomplished by each were, briefly, as follows:

The party under charge of Professor Hall was stationed at La Junta, Colo. The principal results of the work of this party were—

1. Professor Hall made an unsuccessful search for Vulcan with a 5-inch Clark equatorial, magnifying power 150 diameters. The space south of and following the sun was swept over, keeping near the ecliptic, and sweeping about 10° east of the sun. He determined the local time and latitude and longitude of the observing station, assisted by Mr. O. B. Wheeler.

2. Mr. Wheeler made an unsuccessful search for Vulcan with a 5-inch Clark telescope, magnifying 150 diameters, and mounted as an alt-azimuth. The space swept over was below and preceding the sun.

3. Mr. J. A. Rogers made five photographs of the corona. The exposures were 3, 5, 10, 60, and 20 seconds. The camera was mounted equatorially. The image of the moon was .36 of an inch in diameter. As the exposures were increased, more and more of the corona was shown, and the longest exposure gave a corona twenty minutes of arc in extent each side of the sun. These photographs show a great amount of detail, and in connection with those of other parties will probably give more information in regard to the minute structure and extent of the corona than has yet been obtained from photographs.

4. Mr. W. F. Gardner assisted in mounting and adjusting the instrument, and during totality aided Mr. Rogers in making the exposures.

5. Prof. A. W. Wright, of Yale College, made a determination of the plane of polarization of the coronal light, the percentage of polarized light present, and also took two polariscopic photographs.

6. Dr. T. E. Thorpe, of England, determined the magnetic constants for La Junta, and examined the question as to whether there was any change observable in the magnetic instruments during totality. The question was decided in the negative. Photographic experiments were also made by Dr. Thorpe.

The party under the direction of Professor Harkness was stationed at Creston, Wyo., and the work done by it may be summarized as follows:

Professor Harkness, assisted by Lieut. E. W. Sturdy, U. S. N., searched the violet and ultra-violet portions of the coronal spectrum for bright lines, but found none.

Mr. Alvan G. Clark, of Cambridge, Mass., and Assistant Astronomer A. N. Skinner managed the equatorial camera and obtained six photographs of the corona, which are thought to be at least as extensive and rich in detail as any ever taken. The exposures were respectively 3, 15, 30, 60, 8, and 5 seconds. The pictures show the moon three hundred and sixty-two thousandths of an inch in diameter, and for convenience of comparison with the work of other observers it is extremely desirable to enlarge them to the adopted standard size in which the moon is $1\frac{1}{4}$

inches in diameter. With the kind assistance of Mr. L. E. Walker, photographer of the Treasury Department, Mr. J. A. Rogers and Professor Harkness have tried to do this photographically, but thus far the results have not been satisfactory. It seems likely that it will be necessary to resort to drawing, and in that case it may be best to make but one picture from the photographs obtained by the parties of Professors Hall, Harkness, and Holden. In this way, it is thought an extremely accurate representation of the corona will be obtained.

Prof. Otis H. Robinson, of Rochester University, New York, used the polariscopic camera, and obtained four photographs which distinctly show the polarization of the corona. They are now in the hands of Prof. A. W. Wright, who is making a special study of that subject.

In addition to the observations above, the times of the first, second, and fourth contacts were noted by several members of the party. No one was at leisure to note the time of third contact.

The party under direction of Professor Eastman consisted of himself and Prof. Lewis Boss, director of the Dudley Observatory, Albany, N. Y.; Prof. C. W. Pritchett, director of the Morrison Observatory, Glasgow, Mo.; Mr. H. M. Paul, assistant astronomer Naval Observatory; and Mr. H. S. Pritchett, assistant at the Morrison Observatory.

The observing station was in the town of West Las Animas, Colo.

Professor Eastman observed contacts, and, with a single-prism spectroscope attached to a 5-inch equatorial, traced the limit of the substance in the corona which gives the bright line "1474," in the green portion of the spectrum on the north, east, south, and west limbs of the sun. The existence of this line was demonstrated to a distance from the sun's limb equal to about four-tenths of the solar diameter, and the limit was about the same in the four different directions.

Professor Boss determined the latitude and longitude of the station, observed contacts, and, during totality, devoted himself to the study of the details of the structure of the corona.

Professor Pritchett observed contacts, and, during totality, devoted a portion of his time to a search for Vulcan, and the remainder to a study of the solar prominences and one or two portions of the corona.

Assistant Paul observed contacts, and, during totality, sketched the outline of the corona projected on a finely ground glass plate in the focus of a telescope of 48.5 inches focus, with an objective of 3.5 inches.

Mr. H. S. Pritchett assisted Professor Boss in the observations to determine latitude and longitude, observed contacts, and, during totality, pointed the telescope which carried Professor Eastman's spectroscope.

The party under Professor Holden was stationed at Central City, Colo. The work done was as follows:

Professor Holden made an unsuccessful search for Vulcan, and a sketch of the corona.

Dr. C. S. Hastings, professor of physics in Johns Hopkins University, Baltimore, made six independent determinations of the plane of polarization of the coronal light.

Prof. E. W. Bass, United States Military Academy, West Point, made a minute examination of one-half of the corona, and observed the four contacts.

Lieut. S. W. Very, U. S. N., determined the latitude and longitude of Central City, and assisted Dr. Hastings during totality by pointing his telescope.

Mr. J. E. Keeler, assistant in physics in Johns Hopkins University, made a crayon drawing of the corona.

Mr. C. H. Rockwell, of Tarrytown, N. Y., made a sketch of the corona, and noted time for Professor Bass.

Mr. Peers, of Central City, took a photograph of the corona. This photograph is noteworthy, as it gives more of the outer corona than any other, and is a valuable supplement to the photographs of Professors Hall and Harkness. (The outer corona is shown over 60′ on each side of the sun.)

The reports of this party are all prepared, except that of Dr. Hastings, which is nearly completed.

Sketches of the total phase were made by Mr. E. M. Rogers at Central City, Miss Kate Wolcott at Black Hawk, and Miss Risley-Seward at Colorado Springs, and handed to Professor Holden for transmission to the Observatory.

Besides the parties under the immediate direction of the professors at the Observatory, others were dispatched to various points, as before stated. The expenses of these parties were defrayed in whole or in part from the appropriation "for observing the total solar eclipse of July 29, 1878." The final reports of some of these parties have not yet been received, but the following preliminary sketch of their operations is presented:

1. The party under Professor Newcomb, U. S. N., superintendent of the Nautical Almanac, was composed of the chief of party and Commander W. T. Sampson, U. S. N., Lieut. C. G. Bowman, U. S. N., and Mr. John Meier, of the Nautical Almanac Office, and was stationed at Separation, Wyoming.

This party observed contacts, and exposed a large number of (dry) photographic plates in one of the horizontal photo-heliographs belonging to the Naval Observatory. These plates were carefully prepared by Mr. J. A. Rogers, and were exactly similar to those prepared by him which gave such excellent results in the photographs of Mercury in transit at Washington, Cambridge, and Ann Arbor.

When Professor Newcomb's plates came to be developed, however, hardly a trace of an image could be made out upon them; and it would have been presumable that the exposures had not been properly made, if it were not for the fact that Professor Newcomb personally superintended the operation of exposing these plates, and that he is confident that the full beam of sunlight from the heliostat mirror fell on the sensitive plate. As the case now stands, the failure of these plates is inexplicable.

Professor Newcomb conducted a search for Vulcan, which was unsuccessful.

A party consisting of Prof. S. P. Langley, director of the Allegheny Observatory, Penn., and Prof. J. W. Langley, of Michigan University, Ann Arbor, occupied the summit of Pike's Peak. They were engaged in photometric determinations of the light of the corona, etc., and secured valuable drawings; Prof. S. P. Langley was able to trace the corona for several degrees on each side of the sun, and to see it after the reappearance of the sun.

Mr. G. W. Hill, of the Nautical Almanac Office, made a drawing of the corona at Denver, Colo.

Prof. O. Stone, director of the Cincinnati Observatory, and Mr. W. Upton, of Harvard College Observatory, observed the eclipse a few miles east of Denver. Contact and other observations were secured.

Prof. James C. Watson observed at Separation, Wyo., and he has given to the Observatory an account of his discovery of one or perhaps

two intra-Mercurial planets. His original letters have been already published by the Observatory,

Messrs. L. and G. H. Trouvelot, of Cambridge, Mass., observed at Creston, and a fine pastel drawing of the corona has been received from them.

Mr. D. P. Todd, of the Nautical Almanac Office, observed at Dallas, Texas, and in spite of cloudy weather, observed contacts. He also secured a number of observations of the duration of totality from volunteer observers stationed near the limits of total eclipse.

PUBLICATIONS OF THE OBSERVATORY AND THEIR DISTRIBUTION.

The distribution of the volume of the astronomical and meteorological observations made during the year 1874, has been continued in answer to calls from observatories and other scientific institutions, and from individuals directly interested in astronomical work. The distribution of the annual volume is properly limited to these. The foreign distribution has been made as usual, chiefly through the kind offices of the Smithsonian Institution. The next annual volume—that containing the observations for the year 1875—is daily expected from the government press. The observatory has distributed the larger part of each edition of the separate treatises issued during the year; viz, Researches on the Motion of the Moon, Part I, by Professor Newcomb; Instructions for Observing the Transit of Mercury of May 5–6, 1878, communicated to the Superintendent by Professor Newcomb, U. S. N., superintendent of the Nautical Almanac, for the use of observers intending to co-operate with the Obsevatory; Instructions for Observing the Solar Eclipse of July 29, 1878, by Professor Harkness; Observations and Orbits of the Satellites of Mars, by Professor Hall; and the Meteorological Observations made at the Observatory during 1875, by Professor Eastman.

The exchanges received from a number of the chief scientific institutions of our own country and from abroad continue to enhance the value of the library, which is also adding to its astronomical and mathematical volumes standard works purchased under the appropriation made for this purpose last year. A small appropriation for further purchases is submitted in the estimates.

The Narrative of the Residence of the late C. F. Hall among the Esquimaux at Hudson's Bay during the years from 1864 to 1869, inclusive, ordered by the Senate to be prepared from the manuscripts purchased by Congress, and under the charge of Prof. J. E. Nourse, is advancing towards completion. Of the Narrative of the Polaris Expedition, prepared by the late Admiral Davis, no volumes remain at the Observatory. No copies of the 2d or of the 3d edition of this work have been at its disposal.

CHRONOMETERS.

There are at present in the chronometer-room one hundred and thirty-two mean time chronometers, of which thirty-seven are ready for issue, eighty-two need repairs, and thirteen were taken from the Florida. There are also six sidereal chronometers, four of which are break-circuits, and eleven condemned ones, which have been cleaned and put in good order, to be issued to vessels of war as "hacks." There are also ninety-eight condemned chronometers stored away.

During the year eighty-one chronometers have been received at the Observatory and fifty have been issued; twenty-five to vessels of the Navy, of which ten were "hacks."

Twelve chronometers have been condemned during the year on account of age, by order of the Bureau of Navigation.

In issuing chronometers to vessels, the rule is, to select three of different makers, but of regular rates, and one of the "hacks."

In order to determine the effect on a two-day chronometer of allowing it to run forty-eight hours, twelve chronometers were selected and put in a case by themselves and wound only every other day for a period of five rate days (fifty days). They were then wound every day for the same length of time and again allowed to run fifty days, being wound every other day. Their rates for these different periods are given below.

In originally selecting these chronometers, six were taken with a small rate, three with a medium rate, and three with a large rate. The rates of six good chronometerswhich were wound regularly every day are also given for the same periods of time, to be taken as a standard of comparison.

	Chronometers. Name.	Nos.	December 17 to January 16, 30 days before trial.	January 16 to March 7, wound every other day.	March 7 to April 26, wound daily.	April 26 to June 15, wound every other day.	June 15 to July 15, 30 days after trial.
			s.	s.	s.	s.	s.
							To June 25.
1	Negus	1326	+0.222	+0.530	+0.684	+0.599	+0.208
2	Crisp	2101	−1.478	−1.840	−1.736	−1.841	−1.681
3	Negus	700	+0.038	+0.960	+1.154	+0.719	+0.002
							To July 5.
4	Negus	740	+0.938	+1.080	+1.264	+0.789	+0.224
							To June 25.
5	Negus	1340	+0.005	+0.360	+0.634	+0.569	+0.458
6	Birch	1217	−1.495	−1.180	−0.426	+0.269	−0.731
7	Frodsham	3276	+0.905	+1.530	+0.804	+0.649	+0.669
8	Eggert	552	−1.878	−1.560	−1.196	−1.511	−2.048
9	Negus	1262	+1.522	+2.530	+2.704	+2.139	+0.969
10	Barraud	2594	+3.605	+4.870	+4.394	+4.479	+4.119
11	Negus	734	−3.795	−2.870	−3.306	−3.001	−3.065
12	Negus	775	+2.955	+3.020	+3.614	+3.849	+3.402
	Average		+ .120	+ .620	+ .716	+ .644	+ .211

These chronometers were wound daily.

	Chronometers.	Nos.	30 days.	50 days.	50 days.	50 days.	30 days.
			s.	s.	s.	s.	s
1	Chadwick	386	− 1.645	− 1.340	− 0.576	− 0.091	− 0.451
2	Negus	916	− 1.395	− 1.320	− 0.706	− 0.561	*− 0.776
3	Frodsham	2,229	− 0.978	− 1.000	− 0.996	− 0.921	− 1.615
4	Litherland Davies Co	833 17,774	− 0.262	+ 0.040	+ 0.434	+ 0.549	− 0.395
5	Negus	1,074	+ 0.955	+ 1.240	+ 0.704	− 0.441	− 1.665
6	Negus	1,126	+ 0.855	+ 0.780	+ 0.644	+ 0.458	− 0.131
	Average		− .412	− .267	− .083	− .168	− .839

*To July 5.

In the first part of this table the first and last columns of rates show the rates of twelve chronometers for thirty days when wound daily; the second and fourth, their rates for fifty days when wound every other day; and the third, their rates for fifty days when wound every day.

The second part of the table shows the rates of six chronometers when wound daily for the same periods.

In this table of rates no account has been taken of the change of temperature, but it has been presumed that all the chronometers would be affected alike, as they were all in the same room, and affected by the same temperature (this is not strictly true, however), and that any variations in the rates of those which were wound only every forty-eight hours not found in the rates of those which were wound every twenty-four hours might be ascribed to that cause. But, as the rates of all these chronometers vary in about the same manner, and as the average rates of the two sets vary alike also, it is fair to presume that a chronometer can be allowed to run forty-eight hours and be almost as reliable as if wound daily.

Arrangements for dropping a time-ball in New York City at exact New York noon were perfected, and the ball dropped from the chronometer-room for the first time on September 10, 1877. It has been dropped daily (except Sundays and holidays) since that time with but eight exceptions, which are as follows: Twice, owing to trouble with the wire between Washington and New York; three times, owing to derangement of ball apparatus at New York; once, owing to neglect in the chronometer-room; once, to neglect at the Washington telegraph-office; and once, to neglect at New York.

At Washington noon time-signals are transmitted to all parts of the United States, and a time-ball is dropped from the flag-staff on the dome.

Very respectfully, your obedient servant,

JOHN RODGERS,
Rear-Admiral, Superintendent.

Commodore WILLIAM D. WHITING, U. S. N.,
Chief of Bureau of Navigation, Navy Department.

NAUTICAL ALMANAC OFFICE,
Washington, D. C., October 26, 1878.

SIR: In compliance with your order of the 21st instant, I have the honor to submit the following report of the operations of this office during the past year:

The Navigators' Almanac for the year 1881 was issued in February last, and the large Ephemeris for the same year in September last. The printing of the Ephemeris and Almanac for 1882 has commenced, and 75 pages are now in type. The computations of the Ephemeris for 1882 are nearly all completed, and those for 1883 are in progress.

During the year ending September 30, 1878, 473 copies of the American Ephemeris and Nautical Almanac were sold or sent to agents for sale, and 794 copies were distributed for the public service and to scientific institutions. Of the Navigators' Almanac 3,766 copies were sent to agents for sale.

CHANGES IN THE ALMANAC.

In December, 1877, on recommendation of the office, the honorable Secretary of the Navy referred to the National Academy of Sciences the question, what changes were required in the Ephemeris to make it more serviceable to those who use it. A committee of the Academy recommended several extensive changes, involving the omission of matter of which some was not regarded as necessary and some could be readily derived from data in other parts of the work. The space thus left was filled by the addition of matter considered useful. The chiefs of several government surveys desired a large increase in the list of fixed stars

contained in the Ephemeris, in order to facilitate the determination of geographical positions. The changes next in importance consisted in the presentation of more complete data, maps, and diagrams for the eclipses of the sun and the satellites of the planets. The changes were so adjusted that the size and cost of the work should not be materially altered. They commence with the Ephemeris for 1882, now in press.

IMPROVEMENT OF THE TABLES.

With the aid of the additional force employed in the office, several works have been commenced having in view the much-needed improvement of the astronomical tables and data, from which the Ephemeris is constructed.

STAR CATALOGUE.

It is intended to collect all the star places now or hereafter to be used in the preparation of the Ephemeris into a single catalogue and to give the most accurate positions which can be obtained from published observations. The total number of stars in the list may be about 1,300. This work has been commenced by Master Chauncey Thomas, U. S. N., and Mr. J. O. Wiesner, and it is hoped to put two or three other officers or computers upon it so as to complete it next year.

THEORY OF JUPITER AND SATURN.

The very difficult and laborious problem of the perturbations of Jupiter and Saturn has been taken up by Mr. G. W. Hill, whose work on this subject will probably be completed in the course of eighteen months, or sooner if the office should be able to supply him an assistant.

TABLES OF THE MOON.

The comparison of Hansen's tables of the Moon, with observations from 1750 to the present time, in continuation of the researches on the motion of the moon recently published by the Naval Observatory, has been commenced by Mr. John Meier. The work of several computers will, however, be required to bring it to completion.

The prospective scientific value of the above works and of others on the mass of Jupiter and the motions of Jupiter's satellites, preparations to commence which have begun, renders it desirable to carry them to completion as rapidly as is consistent with that accuracy which is their first requirement. The system which the Department has inaugurated of rendering the excellent mathematical training given to young officers at the Naval Academy available in the prosecution of the highest department of astronomical research, by employing them in the computations above described, bids fair to prove entirely successful.

It is proper to state in this connection that the office is under obligations to two distinguished foreign astronomers for the communication of unpublished data relative to this work. These are Dr. Arthur Auwers, of Berlin, who has communicated the results of the re-reduction of Bradley's observations of the stars, made at Greenwich between 1750 and 1762, and Dr. Theodore von Oppolzer, of Vienna.

PRECAUTIONS IN PRINTING.

Typographical and other errors in the Ephemeris are frequently communicated to the office, and have sometimes been unfavorably commented

on in the public prints. As they tend to breed distrust of the care and accuracy with which the work is prepared, it has been deemed necessary to change the system of proof-reading by having this work done entirely in the office under the supervision of a single responsible assistant, Mr. D. P. Todd, who is charged with the final revision of all the office printing.

Very respectfully, your obedient servant,

SIMON NEWCOMB,
Professor, U. S. N.,
Superintendent Nautical Almanac.

Commodore W. D. WHITING, U. S. N.,
Chief Bureau Navigation, Navy Department.

Estimate of appropriations required for the service of the fiscal year ending June 30, 1880, *by the Bureau of Navigation.*

FOR THE SUPPORT OF THE BUREAU OF NAVIGATION.

For salary of chief clerk (Revised Statutes, page 69, section 416, and act of June 19, 1878)	$1,800
For salary of one clerk of third class (Revised Statutes, page 26, section 167, and act of June 19, 1878)	1,600
For salary of one clerk of second class (act of June 19, 1878)	1,400
For salary of messenger (act of June 19, 1878)	720
For salary of laborer (act of June 19, 1878)	660
For contingent expenses	400
Total	6,580

A.

I.—FOR NAVIGATION.

For foreign and local pilotage and towage of ships of war	$45,000
For services and materials for correcting compasses on board ship, and for adjusting and testing compasses on shore	3,000
For nautical and astronomical instruments, nautical books, maps, charts, and sailing directions, and repairs of nautical instruments for ships of war	9,000
For books for libraries of ships of war	2,000
For Navy signals and apparatus, namely, signal-lights, lanterns, rockets, running-lights, drawings, and engravings for signal-books	6,000
For compass-fittings, including binnacles, tripods, and other appendages of ships' compasses	3,000
For logs and other appliances for measuring the ship's way, leads, and other appliances for sounding	3,000
For lanterns and lamps and their appendages for general use on board ship, including those for the cabin, wardroom and steerage; for the holds and spirit-room; for decks and quartermasters' use	5,000
For bunting and other materials for flags, and making and repairing flags of all kinds	4,000
For oil for ships of war, other than that used in the Engineer Department, candles when used as a substitute for oil in binnacles and running-lights; for chimneys and wicks, and soap used in the navigation department	20,000
For stationery for commanders and navigators of vessels of war and for use of courts-martial	1,500
For musical instruments and music for vessels of war	1,000
For steering-signals and indicators, and for speaking-tubes and gongs for signal communication on board vessels of war	2,000
Total	104,500

II.—FOR NAVIGATION CONTINGENT.

For freight and transportation, postage and telegraphing on public business; advertising for proposals; packing-boxes and materials, and all other contingent expenses	$2,000

III.—FOR NAVIGATION.—HYDROGRAPHIC WORK.

For drawing, engraving, purchase of chart-paper, printing, and photolithographing charts, correcting old plates, preparing and publishing sailing directions and other hydrographic information	$40,000
For fuel, lights, and office furniture; care of building and other labor; purchase of books for library; drawing materials and other stationery; postage, freight, and other contingent expenses	4,000
For rent and repair of building	2,000
Total	46,000

B.

I.—FOR NAVAL OBSERVATORY.

For three assistant astronomers, at $1,500 each, and one clerk of class three	$6,100
For one instrument maker, three watchmen, one messenger, and one porter; keeping grounds in order; repairs of buildings and inclosures; fuel, light, and office furniture; chemicals for batteries; stationery, freight, labor, and all other contingent expenses	12,000
For professional books for library	1,000
For reducing and transcribing astronomical and meteorological observations for publications	2,200
Total	21,300

C.

I.—FOR NAUTICAL ALMANAC.

For pay of computers and clerks for preparing for publication the American Ephemeris and Nautical Almanac	$19,000
For rent, fuel, labor, stationery, boxes, expressage, books, and miscellaneous expenses	1,500
For ephemeris of new planets, discovered by American astronomers	2,000
Total	22,500

RECAPITULATION.

Estimate of appropriations required for the fiscal year ending June 30, 1880, by the Bureau of Navigation, Navy Department.

FOR SUPPORT OF BUREAU.

Salaries and contingent	$6,580

FOR THE NAVAL SERVICE.

A.	I.—Navigation	$104,500
	II.—Navigation contingent	2,000
	III.—Navigation, hydrographic work	46,000
B.	I.—Naval Observatory	21,300
C.	I.—Nautical Almanac	22,500
	Total	196,300

Abstract of offers for supplies received for furnishing articles coming under the cognizance of the Bureau of Navigation.

1,500 gallons lard-oil—bureau's order of November 7, 1877.

		Cents.
*Whittier, Fuller & Co., San Francisco, Cal	per gallon	$89\frac{1}{2}$

2,000 gallons lard-oil—bureau's order of March 1, 1878.

		Cents.
*James H. Redfield	per gallon	$59\frac{95}{100}$
Manhattan Oil Company	per gallon	$60\frac{3}{4}$
J. H. Walker	per gallon	$60\frac{95}{100}$
C. E. Wallis	per gallon	$60\frac{98}{100}$

*Accepted.

10,000 gallons lard-oil—bureau's order of June 15, 1878.

		Cents.
*N. K. Fairbanks & Co	per gallon	$58\frac{3}{4}$
Manhattan Oil Company	per gallon	$59\frac{70}{100}$
James Symington	per gallon	$60\frac{24}{100}$
E. T. Howe	per gallon	$62\frac{3}{10}$

No. 6.—BUREAU OF YARDS AND DOCKS.

BUREAU OF YARDS AND DOCKS,
NAVY DEPARTMENT,
Washington, D. C., October 26, 1878.

SIR: In compliance with your order of the 21st instant, I have the honor to submit my annual report for the fiscal year ending June 30, 1878, and estimates for the fiscal year ending June 30, 1880, together with an abstract of offers for furnishing supplies coming under the cognizance of the Bureau of Yards and Docks for the fiscal year ending June 30, 1878.

Very respectfully, your obedient servant,

R. L. LAW,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy, Navy Department,
Washington, D. C.

BUREAU OF YARDS AND DOCKS,
NAVY DEPARTMENT,
Washington, D. C., October 26, 1878.

SIR: In obedience to your order of the 21st instant, I have the honor to submit the annual report of this bureau, and the expenditures for the fiscal year ending June 30, 1878.

I also submit the estimates for the fiscal year ending June 30, 1880.

The estimates submitted by the bureau are exactly the sums appropriated by the second session of the Forty-fifth Congress. The estimates made by the commandants of the several navy yards and stations are also submitted for your information and consideration.

No appropriation for improvements of navy-yards was made for the fiscal year 1878–'79, except the small sum of $75,000 for continuation of work on the Mare Island dry-dock. This sum, except a small amount reserved for unforeseen accidents, will be expended by the middle of December. This work is of such a nature that delay in finishing it will add greatly to the expense. The breaking in of the coffer-dam, a temporary wooden structure intended only to last a reasonable time for the construction of the dock, would greatly injure the work already done and be attended with immense loss to the government; and should such an accident occur during working hours the loss of human life would probably be very great.

I trust Congress may grant such an appropriation as will permit the work to be carried beyond the hazard of its utter destruction by the accidental giving way of the coffer-dam referred to.

On the 23d instant a gale of wind and rain swept over League Island

*Accepted.

Station, causing extensive damage. The dike that surrounds the island and prevents its overflow at each tide was broken through in 35 places, aggregating a width of 1,395 feet, by the high water, and the whole place not filled in, above any tide yet known, was overflowed to a depth of about seven feet.

The expense of repairing this damage so as to exclude the water will probably be about $10,000, and then the repairs will be only of a temporary nature; to do it properly and raise the dike around the island to a point beyond the reach of future flood, the estimated cost would be about $50,000.

This gale also did damage to a number of buildings to a greater or less extent, unroofing some and utterly demolishing a large ship-house.

The small sum appropriated for repairs has been judiciously expended, but with every care and the most frugal use of the appropriation, I find costly store-houses, ship-houses, workshops, and other improvements going to decay, rapidly depreciating in value for the want of means to repair roofs, to paint, to drain; and to do the work of preservation, temporary repairs, make-shifts, are all the work the bureau has been able to accomplish with the means at its command.

The remarks under the heads of the several yards and stations will inform you in detail of their condition.

PORTSMOUTH, N. H.

During the past fiscal year all the means allotted for repairs and preservation have been expended in the most economical and judicious manner for the preservation of the public property under the cognizance of this bureau. Roofs, foundations, and glazing have been repaired, as these objects are of vital importance; painting and more thorough repairs have been deferred for want of funds. Bridges, wharves, and landing-stages have been so far kept in order as to prevent any accidents or damage to persons or property. Hospital building No. 28 has been renovated and improved inside and outside; the grounds have been graded and drains laid to tide-water, to insure a dry cellar in rainy seasons. Improvements have been introduced which have added greatly to the healthfulness of the premises, the comfort of the sick, and conveniences of nurses and attendants. The hospital is now, what it never was before, comfortable in all seasons of the year and in fair repair.

The dry-dock has been repaired so far as the money allotted would permit; the 24 pumps of the dock have been refitted, and in several instances decayed timbers and planks have been removed and the necessary repairs made. The hydraulic and pumping apparatus are all in good order and ready for use when required.

It has not been possible, with the very inadequate allotment under this appropriation, to meet all the calls for repairs; such only as were of the most urgent necessity were attended to, and in numerous other cases which were unavoidably neglected the process of decay and deterioration is rapidly going on.

There has been expended at this yard, under the head of "Repairs and preservation," during the fiscal year ending June 30, 1878—

For materials	$10,305 52
For labor	3,587 50
Total	13,893 02

The amount allotted under the head of "General maintenance" has been expended, under the various enumerated items, as economically as possible, in view of the small amount of the appropriation.

There has been expended during the fiscal year—

For materials	$8,272 53
For labor	28,048 14
Total	36,320 67

The expenditure under the head of "Civil establishment" is—

Civil establishment	$4,417 14

The total expenditures at this yard during the fiscal ending June 30, 1878, are—

For repairs and preservation	$13,893 02
For general maintenance	36,320 67
For civil establishment	4,417 14
Total expenditures	54,630 83

The estimates submitted by the authorities at this yard, for the fiscal year ending June 30, 1880, are—

For works of improvement	$127,450 43
For repairs and preservation	49,500 00
For general maintenance	69,725 00
For civil establishment	5,900 00
Making the aggregate of	252,575 43

BOSTON, MASS.

During the fiscal year ending June 30, 1878, no extensive repairs have been made to any one particular object or building, owing to the small allotment under this appropriation; patching and slight repairs have been in continual progress upon the various and numerous yard buildings, and they are in as good condition as the funds at the disposal of the bureau would permit. The officers' quarters are generally in pretty good repair and are comfortable. The repairs upon roads, walks, drains, sewers, and water and gas pipes have been performed as circumstances required.

All the general repairs throughout the yard are of a miscellaneous character, and have been performed with as much regard to economy as possible.

The amount expended under the head of "Repairs and preservation" during the fiscal year ending June 30, 1878, is—

For materials	$1,512 84
For labor	20,767 95
Total	22,280 79

The expenditures under "General maintenance" during the fiscal year have been applied to the several objects coming under this head, as shown in the tabular statement No. 3.

The amounts authorized during the past three years have been quite inadequate to meet the legitimate demands upon this fund; they are numerous and of a pressing character.

There has been expended during the fiscal year—

For materials	$14,500 69
For labor	39,728 44
Total	54,229 13

The expenditure under head of "Civil establishment" is—

Civil establishment	$4,417 25

The total expenditure at this yard during the fiscal year ending June 30, 1878, is—

For repairs and preservation	$22,280 79
For general maintenance	54,229 13
For civil establishment	4,417 25
Total expenditures	80,927 17

The estimates submitted by the authorities of the yard for the fiscal year ending June 30, 1880, are—

For works of improvement	$164,247 49
For repairs and preservation	146,970 00
For general maintenance	99,200 00
For civil establishment	8,073 50
Total	418,490 99

NEW LONDON, CONN.

At this yard there has been expended during the past fiscal year, under head of "Navy-yard, New London," for materials, $144.44.

Such repairs as were necessary have been made to the buildings, and the amount expended under head of "Repairs and preservation" is—

For materials	$37 63
For labor	271 77
Total	309 40

The amount expended under head of "General maintenance" is—

For materials	$253 33
For labor	4,708 85
Total	4,962 18

The amount expended under "Civil establishment" is—

Civil establishment	$1,014 00

The total expenditure during the fiscal year ending June 30, 1878, is—

For works of improvement	$144 44
For repairs and preservation	309 40
For general maintenance	4,962 18
For civil establishment	1,014 00
For contingent	65 00
Total expenditures	6,495 02

The estimates submitted by the authorities of the yard for the fiscal year ending June 30, 1880, are—

For works of improvement	$318,469 10
For repairs and preservation	1,825 70
For general maintenance	23,915 00
For civil establishment	7,977 25
Total estimates	352,187 05

NEW YORK, N. Y.

Owing to the very limited appropriations for repairs and preservation for several years past, many very necessary repairs to the numerous buildings at this important yard have been neglected, and now a considerable expenditure is necessary to prevent further deterioration. During the past year the allotment under this head has been expended upon

the objects of first importance, and great economy and good judgment have been exercised in the expenditures; still there are many repairs required, which should be executed promptly or the public interests must suffer.

The amount expended under the head of "Repairs and preservation" is shown in tabular statement No. 2, and is—

For materials	$8,436 25
For labor	14,094 92
Total	22,531 17

The amount expended under the head of "General maintenance" is shown in detail in tabular statement No. 3, and is—

For materials	$18,777 87
For labor	72,469 33
Total	91,247 20

The expenditure under head of "Civil establishment" for the fiscal year is—

Civil establishment	$5,723 53

The total expenditures at this yard during the fiscal year ending June 30, 1878, are—

For repairs and preservation	$22,531 17
For general maintenance	91,247 20
For civil establishment	5,723 53
Total expenditures	119,501 90

The estimates submitted by the authorities of the yard for the fiscal year ending June 30, 1880, are—

For works of improvement	$1,308,133 63
For repairs and preservation	115,000 00
For general maintenance	99,150 00
For civil establishment	4,656 25
Total estimates	1,526,939 88

LEAGUE ISLAND, PA.

During the past year the expenditures under head of "Navy-yard, League Island," were made upon the following objects: Saw-mill, guard-house, watch-house, causeway and bridge, dredging and filling in, iron-plating shop, steam-engineering store-house, docking apparatus and mold-loft, blacksmith-shop and foundery, extension of wharf, and grading. These works have been prosecuted with vigor; some of them are completed, and others are well advanced. On these various objects there has been expended during the fiscal year—

For materials	$68,633 84
For labor	57,195 34
Total	125,829 18

Proper care and attention have been bestowed upon the various buildings, roads, walks, wharves, and other improvements, and such repairs have been applied as their condition required. The amount expended under the head of repairs and preservation is—

For materials	$8,952 83
For labor	15,369 33
Total	24,322 16

The amount expended under head of "General maintenance" is shown in detail in paper No. 3, and is—

For materials	$9,050 02
For labor	42,923 15
Total	51,973 17

The money expended under head of "Civil establishment" is—

Civil establishment	$6,921 25

The expenditures under head of "Contingent" amount to—

Contingent	$10,400 00

The total expenditures at this yard during the fiscal year ending June 30, 1878, are—

For works of improvement	$125,829 18
For repairs and preservation	24,322 16
For general maintenance	51,973 17
For civil establishment	6,921 25
For contingent	10,400 00
Total expenditures	219,445 76

The estimates submitted by the authorities of the yard for the fiscal year ending June 30, 1880, are as follows:

For works of improvement	$1,607,000 00
For repairs and preservation	50,000 00
For general maintenance	80,000 00
For civil establishment	7,600 00
Total estimates	1,744,600 00

WASHINGTON, D. C.

The expenditures under the head of "Repairs and preservation" for the fiscal year have been—

For materials	$6,473 42
For labor	9,857 94
Total	16,331 36

The utmost economy has been observed in the expenditure of the funds under this head; slight repairs, such as were indispensable, have been put upon the numerous buildings and other works, but, in consequence of the very limited amount of the appropriation, many important repairs were necessarily deferred for want of funds, and some of the buildings must suffer by the delay.

The amount expended under the head of "General maintenance" is—

For materials	$13,389 37
For labor	39,637 96
Total	53,027 33

The expenditure under head of "Civil establishment" is—

Civil establishment	$4,413 03

Under the head of "Contingent" there has been expended—

For materials	$500 48
For labor	257 00
Total	757 48

The total expenditures at this yard during the fiscal year ending June 30, 1878, were—

For repairs and preservation	$16,331 36
For general maintenance	53,027 33
For civil establishment	4,413 03
For contingent	757 48
Total expenditures	74,529 20

The estimates submitted by the authorities of the yard for the fiscal year ending 30th June, 1880, are—

For improvement of yard	$12,604 70
For repairs and preservation	162,090 00
For general maintenance	69,110 00
For civil establishment	4,617 25
Total estimates	248,421 95

NORFOLK, VA.

The amount expended at this yard under head of "Repairs and preservation" during the past fiscal year is—

For materials	$7,135 68
For labor	14,381 66
Total	21,517 34

The amount expended under head of "General maintenance" is—

For materials	$8,534 84
For labor	41,173 03
Total	49,707 87

The amount expended under head of "Contingent" is—

Contingent	$184 38

The amount expended under head of "Civil establishment" is—

Civil establishment	$5,268 42

The total expenditures during the fiscal year are—

For repairs and preservation	$21,517 34
For general maintenance	49,707 87
For civil establishment	5,268 42
For contingent	184 38
Total	76,678 01

The estimates submitted by the authorities of the yard for the fiscal year ending 30th June, 1880, are—

For works of improvement	$641,926 09
For repairs and preservation	100,478 51
For general maintenance	72,850 79
For civil establishment	7,039 00
Total estimates	822,294 39

PENSACOLA, FLA.

The amount expended for this yard under head of "Navy-yard, Pensacola," during the fiscal year ending 30th June, 1878, it being for the iron floating-dock, now building for this yard, is—

on floating-dock	$161,788 00

There has been expended during the year for objects coming under the head of "Repairs and preservation"—

For materials	$3,290 85
For labor	4,972 20
Total	8,263 05

The amount expended under the head of "General maintenance" is—

For materials	$4,156 04
For labor	21,768 34
Total	25,924 38

The amount expended under head of "Civil establishment" is—

Civil establishment	$2,414 00

The total expenditures during the fiscal year are—

For dry-dock	$161,788 00
For repairs and preservation	8,263 05
For general maintenance	25,924 38
For civil establishment	2,414 00
Total expenditures	198,389 43

The estimates submitted by the authorities of the yard for the fiscal year ending 30th June, 1880, are—

For works of improvement	$66,620 82
For repairs and preservation	34,958 15
For general maintenance	44,000 58
For civil establishment	3,417 35
Total estimates	148,996 90

MARE ISLAND, CAL.

The amount expended at this yard under the head of "Yard improvements" during the past fiscal year is—

Yard improvements	$3,448 00

which has been expended upon the new stone dry dock.

Under the head of "Repairs and preservation" there has been expended—

For materials	$3,538 69
For labor	19,759 58
Total	23,298 27

The amount expended under the head of "General maintenance" is—

For materials	$14,873 40
For labor	45,877 57
Total	60,750 97

The amount expended under head of "Civil establishment" is—

Civil establishment	$6,162 87

The amount expended under head of "Contingent" is—

Contingent	8,998 74

The total expenditures at this yard during the fiscal year ending 30th June, 1878, are—

For works of improvement	$3,448 00
For repairs and preservation	23,298 27
For general maintenance	60,750 97
For civil establishment	6,162 87
For contingent	8,998 74
Total expenditures	102,658 85

The estimates submitted by the authorities of the yard for the fiscal year ending 30th June, 1880, are—

For works of improvement	$1,624,698 18
For repairs and preservation	209,000 00
For general maintenance	117,560 00
For civil establishment	7,900 00
Total	1,959,158 08

SACKET'S HARBOR.

The amount expended at this station under the head of "General maintenance" during the fiscal year ending 30th June, 1878, is $724.82.

The amount estimated for repairs and preservation during the fiscal year ending 30th June, 1880, is $2,000.

KEY WEST, FLA.

The amount expended at this station under the head of "Repairs and preservation" during the past fiscal year is—

For materials	$1,027 48
For labor	1,544 72
Total	2,572 20

The amount expended under the head of "General maintenance" is—

General maintenance	$1,163 75

The total expenditures during the year are—

For repairs and preservation	$2,572 20
For general maintenance	1,163 75
Total expenditures	3,735 95

The estimates submitted by the authorities at the station for the fiscal year ending 30th June, 1880, are—

For works of improvement	$30,000 00
For repairs and preservation	19,450 00
For general maintenance	2,175 00
Total estimates	51,625 00

NAVAL ASYLUM.

There were on the 1st July, 1877, 11 officers, 30 attendants, and 141 beneficiaries on the rolls of the asylum. During the fiscal year ending 30th June, 1878, 26 beneficiaries have been admitted, 14 have died, 4 have been dismissed for misconduct, 2 were discharged at their own request, and 1 sent to the hospital for the insane.

During the fiscal year the usual careful attention has been bestowed

upon the inmates, and everything necessary has been done to render the condition of the beneficiaries as comfortable as possible; as a general rule the conduct of these old sailors has been good. Occasionally there are unruly and disorderly men among them, but such cases are generally suppressed by a proper administration of the rules and regulations for the government of the institution.

The expenditures during the year have been—

For pay and pocket-money of beneficiaries	$3,264 01
For tobacco	1,187 91
For clothing, boots and shoes	7,853 05
For subsistence	16,679 46¾
For dry goods, lumber, coal and wood, paints, provender, hardware, and miscellaneous articles	7,518 32
For pay of employés	7,640 96
For furnaces, grates, and ranges	300 00
For water-rent and gas	1,735 12
For furniture and repairing same	499 25
For increase of library, and car-tickets	250 00
For cemetery and burial expenses	349 94
For repairs and preservation	936 59
Total	48,214 61¾

Estimates have been submitted by the governor of the institution for its support during the fiscal year ending 30th June, 1880, amounting in the aggregate to $77,559.

No. 1.—*Report of expenditures of navy-yards, stations, and Naval Asylum, for the fiscal year ending June 30, 1878.*

Yards and stations.	Appropriations.					
	Yard improvements.	Repairs and preservation.	General maintenance.	Civil establishment.	Contingent.	Totals.
Portsmouth, N. H		$13,893 02	$36,320 67	$4,417 14		$54,630 83
Boston, Mass		22,280 79	54,229 13	4,417 25		80,927 17
New London, Conn	$144 44	309 40	4,962 18	1,014 00	$65 00	6,495 02
New York, N. Y		22,531 17	91,247 20	5,723 53		119,501 90
League Island, Pa	125,829 18	24,322 16	51,973 17	6,921 25	10,400 00	219,445 76
Washington, D. C		16,331 36	53,027 33	4,413 03	757 48	74,529 20
Norfolk, Va		21,517 34	49,707 87	5,268 42	184 38	76,678 01
Pensacola, Fla	161,788 00	8,263 05	25,924 38	2,414 00		198,389 43
Mare Island, Cal	3,448 00	23,298 27	60,750 97	6,162 87	8,998 74	102,658 85
Sacket's Harbor, N. Y			724 82			724 82
Key West, Fla		2,572 20	1,163 75			3,735 95
Naval Asylum, Pa	48,214 61					48,214 61
Wharf at Erie, Pa					500 00	500 00
Totals	339,424 23	155,318 76	430,031 47	40,751 49	20,905 60	986,431 55

No. 2.—*Detailed report from navy-yards and stations of expenditures under "Repairs and preservation" during the fiscal year ending June 30, 1878.*

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Key West.	Totals.
Yard buildings	$3, 288 90	$7, 887 63	$187 15	$5, 782 81	$14, 368 28	$5, 538 39	$9, 131 12	$1, 183 98	$9, 925 73	$2, 178 84	$59, 472 29
Officers' quarters	1, 249 80	3, 022 48	50 28	2, 190 74	546 57	1, 271 47	2, 403 59	1, 997 23	6, 496 36		19, 228 52
Wharves, bridges, landings, and boats	1, 369 34	583 38	10 94	1, 217 38	342 90	4, 618 33	2, 223 67	3, 285 13	2, 168 74		15, 819 81
Roads, walks, gutters, and drains	1, 376 98	4, 447 73	26 16	3, 655 59	4, 613 92	615 40	2, 278 96	180 57	1, 751 61	364 65	19, 511 57
Fences and walls	1, 036 30	347 76	1 60	6, 742 20	167 26	37 60	412 21	713 08	1, 642 16		11, 100 17
Cranes, scows, and derricks	91 60	211 92		357 25	51 12	1, 253 12	34 75	227 92	478 93		2, 706 01
Furnaces, forges, heating apparatus, &c	1, 969 44	870 26	17 67	191 83	336 78	393 08	483 15	16 50			4, 278 71
Tracks and scales	25 00	115 30		84 22	17 52	716 20	134 07		25 44	28 71	1, 146 46
Water and gas works	1, 010 91	4, 509 82	15 60	1, 271 92	171 75	466 58	1, 105 39		439 57		8, 991 44
Dredging and scowing				8 14		1, 382 69	333 50				1, 724 33
Dry-dock	1, 020 61	49 22		538 21	368 49		244 26	5 00	189 96		2, 415 75
Miscellaneous repairs	1, 455 38	235 29		490 88	3, 337 57	38 50	2, 732 67	653 64	179 77		9, 123 70
Totals	13, 893 62	22, 280 79	309 49	22, 531 17	24, 322 16	16, 331 36	21, 517 34	8, 263 05	23, 298 27	2, 572 20	155, 518 76

No. 3.—*Detailed report of expenditures, under "General maintenance," received from navy-yards and stations during the fiscal year ending June 30, 1878.*

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Key West.	Sacket's Harbor.	Totals.
Freight and transportation					$18 00	$276 76	$91 00		$8,371 38			$8,757 14
Printing, stationery, and advertising	$232 71	$295 55	$42 57	$990 94	1,218 14	313 12	243 57	$272 32	1,104 16	$34 15		4,747 23
Books, maps, models, and drawings		17 00			568 58	29 53	606 98		279 58			1,501 67
Purchase and repair of fire-engines	607 83	14 41		252 78	593 03		201 03	405 83	745 64			2,820 55
Machinery of every description and patent rights		447 11		235 74	1,294 35	2,225 68	118 87	306 35	2,865 86			7,493 96
Repairs on steam-engines and attendance on same	225 98	1,365 38		3,244 33	712 57	339 73	1,247 30	1,737 37	932 69			9,805 35
Purchase and maintenance of oxen and horses, pay of hired teams, &c.	5,397 32	10,106 08	105 74	14,885 73	10,450 27	3,927 05	9,913 65	3,589 10	8,452 80			66,827 74
Carts, timber-wheels, and tools of every description	1,703 69	2,344 80	18 43	3,680 78	1,596 75	1,577 11	7,588 72	1,586 82	603 10			20,700 20
Postage on letters on public service and telegrams.	33 56	159 81	5 50	39 22	672 23	20 54	105 29	900 00	29 51			1,965 66
Furniture for government houses and offices in navy-yards	1,905 65	302 51		1,197 80	338 10	1,193 62	1,371 76	384 04	1,337 44			8,030 92
Coal and other fuel for yards and docks purposes	3,549 66	2,461 76	72 50	1,468 57	2,308 39	1,566 35	562 23	270 00	2,349 09			14,608 55
Candles, oil, and gas	2,769 76	2,118 41	29 62	3,770 00	268 04	1,229 88	3,073 95	547 48	7,204 99			21,012 13
Clearing and cleaning up yard and care of buildings	3,832 57	7,754 48	1,058 62	17,076 18	3,346 86	25,583 05	6,065 67	7,703 77	4,478 36	34 60		76,934 16
Attendance on fires, lights, fire-engines and apparatus	3,243 96	3,303 40	4 00	7,848 35	8,143 67	2,705 87	3,875 36	527 25	423 95			30,075 81
Incidental labor, not chargeable to other appropriations	5,988 71	779 38	1,343 16	8,234 27	6,975 97	1,612 27	1,487 07		7,689 74		$724 82	34,835 39
Water tax	100 00	5,574 74	62 04	4,574 77			13 50	33 60	5,105 12			15,463 77
Tolls and ferriages	5 53		32 00	162 90			141 00		2,950 68			3,291 21
Pay of watchmen	6,588 00	17,118 20	2,188 00	23,542 32	13,325 00	10,361 50	12,874 22	7,596 00	5,786 10	1,095 00		100,474 34
Flags, awnings, and packing boxes	60 74	66 11		43 42	143 22	65 27	126 70	64 45	40 78			610 69
Rent of landing	75 00											75 00
Totals	36,320 67	54,229 13	4,962 18	91,247 20	51,973 17	53,027 33	49,707 87	25,924 38	60,750 97	1,163 75	724 82	430,031 47

No. 4.—*Estimates received from navy-yards, stations, and Naval Asylum, for fiscal year ending June* 30, 1880.

Yards and stations.	Appropriations.				
	Yard improvements.	Repairs and preservation.	General maintenance.	Civil establishment.	Totals.
Portsmouth	$127, 450 43	$49, 500 00	$69, 725 00	$5, 900 00	$252, 575 43
Boston	164, 247 49	146, 970 00	99, 200 00	8, 073 50	418, 490 99
New London	318, 469 10	1, 825 70	23, 915 00	7, 977 25	352, 187 05
New York	1, 308, 133 63	115, 000 00	99, 150 00	4, 656 25	1, 526, 939 88
League Island	1, 607, 000 00	50, 000 00	80, 000 00	7, 600 00	1, 744, 600 00
Washington	12, 604 70	162, 090 00	69, 110 00	4, 617 25	248, 421 95
Norfolk	641, 926 09	100, 478 51	72, 850 79	7, 039 00	822, 294 39
Pensacola	66, 620 82	34, 958 15	44, 000 58	3, 417 35	148, 996 90
Mare Island	1, 624, 698 18	209, 000 00	117, 560 00	7, 900 00	1, 959, 158 18
Sacket's Harbor		2, 000 00			2, 000 00
Key West	30, 000 00	19, 450 00	2, 175 00		51, 625 00
Naval Asylum	77, 559 00				77, 559 00
Totals	5, 978, 709 44	891, 272 36	677, 686 37	57, 180 60	7, 604, 848 77

No. 5.—*Detailed estimates from yards and stations for works of improvement for fiscal year ending June* 30, 1880.

Yards and stations, and objects.	Estimates.	Totals.
PORTSMOUTH, N. H.		
For machinery-building	$12, 032 00	
For stables	20, 927 50	
For paving, gutters, and drains	12, 970 00	
For steam-engineering smithery	7, 926 25	
For timber-shed	30, 834 96	
For foundery	17, 362 22	
For heating apparatus	17, 613 50	
For water-works	7, 784 00	
		$127, 450 43
BOSTON, MASS.		
For boundary-wall	15, 618 20	
For water and gas works	21, 226 28	
For cart-shed	16, 511 41	
For civil engineer's workshops, &c	55, 450 19	
For extension of officers' quarters	4, 620 23	
For paving and grading	31, 926 18	
For new floor to rope-walk	18, 895 00	
		164, 247 49
NEW LONDON, CONN.		
For quay-wall	233, 900 00	
For grading	75, 000 00	
For foundations for yards and docks storehouse, &c	9, 569 10	
		318, 469 10
NEW YORK, N. Y.		
For commencing new dry-dock	1, 000, 000 00	
For shipwrights' shed and oakum-store	23, 873 25	
For timber-shed	61, 120 54	
For timber and knee basin	100, 321 47	
For yard-wall (Flushing and Washington avenues)	90, 000 00	
For coal-depot	32, 818 37	
		1, 308, 133 63
LEAGUE ISLAND, PA.		
For commencing quay-wall on Delaware front	392, 000 00	
For commencing quay-wall for deep basin	228, 000 00	
For storehouse for construction and repair	197, 000 00	
For storehouse for equipment and recruiting	208, 000 00	
For dredging and filling in	310, 000 00	
For grading and graveling	90, 000 00	
For sewerage and drainage (commencing)	50, 000 00	
For water-works	72, 000 00	
For improvement of dikes	60, 000 00	
		1, 607, 000 00
WASHINGTON, D. C.		
For purchase of square No. 853		12, 604 70

No. 5.—*Detailed estimates from yards and stations, &c.*—Continued.

Yards and stations, and objects.	Estimates.	Totals.
NORFOLK, VA.		
For timber-shed, No. 32	$42, 959 36	
For timber-shed, No. 33	42, 959 36	
For coal-house, No. 54	54, 485 59	
For chain and cordage store, No. 63	21, 593 48	
For railroad and engine house	32, 480 73	
For extension of erecting shop, No. 23	14, 543 25	
For boiler-shop, No. 41	43, 732 40	
For coal, engine, and boiler house, No. 8	7, 921 02	
For molding-sand house, No. 25	5, 400 26	
For extension of south wing of machine-shop	4, 865 99	
For officers' quarters, G	4, 819 47	
For extension of quay-wall	320, 775 00	
For cistern near foundery	4, 889 18	
For wet-dock at Saint Helena	40, 501 00	
		$641, 926 09
PENSACOLA, FLA.		
For timber-shed, No. 11	28, 590 03	
For spar-shed and cooper's shop, No. 38	38, 030 79	
		66, 620 82
MARE ISLAND, CAL.		
For continuation of stone dry-dock	650, 000 00	
For tools and machinery for machine and joiner's shops	28, 000 00	
For removal of gas-holder and gas-works	5, 238 00	
For completing water-mains and service-pipes	15, 393 34	
For roads and pavements	67, 613 00	
For work-shop and store-house for yards and docks	193, 984 01	
For extension of timber-shed, No. 94	20, 000 00	
For carpenter's shop and mold-loft	125, 875 00	
For dredging and scowing	45, 000 00	
For quay-wall and wharves	100, 000 00	
For new timber-shed, No. 58	99, 564 98	
For commencing ship-house and launching-ways	189, 029 85	
For ferry-boats	85, 000 00	
		1, 624, 698 18
KEY WEST, FLA.		
For new wharf		30, 000 00
NAVAL ASYLUM.		
For support of beneficiaries, improvements, and all expenses		77, 559 00
Aggregate		5, 978, 709 44

No. 6.—*Detailed estimates from navy-yards and stations for "Repairs and preservation" for the fiscal year ending June 30, 1880.*

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Sacket's Harbor.	Key West.	Totals.
Yard buildings	$25,000 00	$35,000 00	$394 70	$30,000 00	$17,110 00	$47,000 00	$34,280 23	$19,412 55	$20,000 00	$2,000 00	$2,500 00	$232,697 48
Officers' quarters	4,500 00	10,000 00	280 00	5,000 00	1,340 00	12,000 00	2,244 63	2,297 68	10,000 00	....	....	47,662 31
Wharves, bridges, landings, and boats	4,500 00	10,000 00	387 00	20,000 00	2,100 00	33,029 00	11,852 85	7,069 80	15,000 00	....	16,000 00	119,938 65
Roads, walks, gutters, and drains	3,000 00	8,000 00	243 00	25,000 00	3,940 00	4,000 00	17,887 19	2,471 14	8,000 00	....	300 00	72,841 33
Fences and walls	300 00	2,500 00	316 00	1,000 00	500 00	21,711 00	5,850 25	....	6,000 00	....	150 00	38,327 25
Cranes, scows, and derricks	4,000 00	2,500 00	....	1,000 00	930 00	7,800 00	6,409 67	167 70	45,000 00	....	....	67,807 37
Furnaces, forges, heating apparatus, &c	3,000 00	1,500 00	105 00	2,000 00	470 00	12,250 00	282 50	....	4,000 00	....	....	23,607 50
Tracks and scales	100 00	5,000 00	....	8,000 00	5,120 00	2,300 00	1,220 27	670 50	5,000 00	....	....	27,410 77
Water and gas works	3,500 00	10,000 00	100 00	4,000 00	2,540 00	1,000 00	2,706 81	2,569 50	6,000 00	....	....	32,416 31
Dredging and scowing	....	500 00	....	10,000 00	2,480 00	11,000 00	13,923 28	....	20,000 00	....	....	57,903 28
Dry-dock	1,500 00	60,470 00	....	4,000 00	4,880 00	5,000 00	1,392 21	....	52,000 00	....	....	129,242 21
Miscellaneous repairs	100 00	1,500 00	....	5,000 00	8,590 00	5,000 00	2,428 62	299 28	18,000 00	....	500 00	41,417 90
Totals	49,500 00	146,970 00	1,825 70	115,000 00	50,000 00	162,090 00	100,478 51	34,958 15	209,000 00	2,000 00	19,450 00	891,272 36

No. 7.—*Detailed estimates for "General maintenance," received from yards and stations, for the fiscal year ending June 30, 1880.*

Objects.	Portsmouth, N. H.	Boston, Mass.	New London, Conn.	New York, N. Y.	League Island, Pa.	Washington, D. C.	Norfolk, Va.	Pensacola, Fla.	Mare Island, Cal.	Key West, Fla.	Totals.
Freight and transportation	$50 00	$100 00	$100 00	$50 00	$100 00	$50 00	$100 00	$500 00	$9,000 00		$10,050 00
Printing, stationery, and advertising	500 00	1,500 00	200 00	1,000 00	1,000 00	1,200 00	500 00	500 00	3,500 00	$35 00	9,935 00
Book, maps, models, and drawings	100 00	100 00		100 00	500 00	50 00	1,140 70	100 00	4,700 00		6,790 70
Purchase and repair of fire-engines	10,000 00	1,500 00		300 00	800 00	4,000 00	1,821 70	4,213 75	2,000 00		24,635 45
Machinery of every description and patent rights	100 00	1,000 00	3,300 00	300 00	5,000 00	1,500 00	2,281 50	310 00	4,000 00		17,791 50
Repairs on steam-engines and attendance on same	100 00	3,000 00	1,139 00	3,500 00	2,000 00	5,000 00	2,613 36	3,730 50	5,000 00		26,112 86
Purchase and maintenance of oxen and horses, pay of hired teams, &c	7,000 00	16,000 00	4,256 00	15,000 00	15,000 00	4,500 00	15,359 06	4,772 30	20,000 00		101,887 36
Carts, timber-wheels, and tools of every description	2,500 00	10,000 00	3,440 00	4,000 00	5,000 00	2,000 00	9,150 04	2,760 00	3,500 00	75 00	42,425 04
Postage on letters on public service and telegrams	50 00	250 00	200 00	50 00	500 00	50 00	200 00	960 00	60 00		2,320 00
Furniture for government houses and offices in navy-yards	10,000 00	2,000 00	940 00	1,500 00	1,000 00	5,000 00	4,864 99	600 00	6,000 00	100 00	32,004 99
Coal and other fuel for yards and docks purposes	6,500 00	5,000 00	1,200 00	3,000 00	2,500 00	2,500 00	1,051 35		7,000 00		28,751 35
Candles, oil, and gas	2,500 00	3,000 00	200 00	4,500 00	500 00	2,000 00	3,350 00	930 00	9,500 00	40 00	26,520 00
Clearing and cleaning up yard and care of buildings	6,000 00	18,000 00	1,600 00	17,000 00	8,500 00	15,000 00	7,311 09	9,688 92	2,000 00	375 00	85,475 01
Attendance on fires, lights, fire-engines and apparatus	5,000 00	5,500 00		8,500 00	9,000 00	6,000 00	4,792 80	534 18	3,000 00		42,326 98
Incidental labor, not chargeable to other appropriations	6,000 00	3,000 00	3,920 00	9,500 00	15,000 00	8,000 00	1,535 00	4,239 93	11,000 00	300 00	62,494 93
Water tax	100 00	10,000 00	100 00	5,500 00			30 00	201 60	5,700 00		21,631 60
Tolls and ferriages	50 00		150 00	200 00			280 00		3,000 00		3,680 00
Pay of watchmen	13,000 00	19,000 00	2,920 00	25,000 00	13,500 00	12,010 00	15,877 50	9,768 00	18,000 00	1,250 00	130,325 50
Flags, awnings, and packing-boxes	100 00	250 00	250 00	150 00	100 00	250 00	561 70	191 40	600 00		2,453 10
Rent of landing	75 00										75 00
Totals	69,725 00	99,200 00	23,915 00	99,150 00	80,000 00	69,110 00	72,850 79	44,000 58	117,560 00	2,175 00	677,686 37

MARE ISLAND, CALIFORNIA.

For continuation of stone dry-dock, $75,000.

During the past three years the work upon this important object has been dragging along at a snail's pace, owing to the apparent unwillingness of Congress to appropriate money for the completion of this great national work. Three years ago there was an appropriation of $50,000, which was barely sufficient to keep the works in order, and the next year not a dollar was appropriated, and consequently the progress was suspended and the year lost. For the present year $75,000 were appropriated, and the work has been resumed, and by the 1st of December next nearly all of the appropriation will be expended. The bureau in its annual reports has repeatedly urged the necessity for large appropriations for this object, that it might be pushed forward to at least a point of safety; but as the amounts appropriated seem to indicate the wishes of Congress on the subject, the small amount appropriated for the present fiscal year is estimated for the next.

REPAIRS AND PRESERVATION.

The estimate under this head is the same as the amount appropriated for the present fiscal year. A much larger sum might be judiciously expended and result in great benefit to the government. Many of the buildings in the navy-yards are large and costly structures, and a neglect to apply timely repairs must necessarily result in rapid deterioration and loss to the government.

GENERAL MAINTENANCE.

The estimate submitted for this object is the same as the appropriation for the present fiscal year, and is much less than appropriations for former years. To meet the numerous demands upon this fund requires the exercise of great care and economy, and often causes much embarrassment.

CONTINGENT.

The small amount asked for for this object is to defray the expense of unforeseen casualties which may occur at the various yards during the fiscal year, and its expenditure is always carefully guarded.

NAVAL ASYLUM.

The amount submitted for this institution is the same as that appropriated for the present fiscal year, and it is believed that by prudent and careful management it will meet the necessary expenses of the institution.

Accompanying this report is an abstract of offers for supplies, received for furnishing articles coming under the cognizance of the Bureau of Yards and Docks, made in conformity to the act of Congress approved March 3, 1843.

The following estimates for the fiscal year ending June 30, 1880, are respectfully submitted:

Sheet No. 1. For support of Bureau of Yards and Docks..	$12,780 00
Sheet No. 2. General maintenance, Yards and Docks, and contingent	460,000 00
Sheet No. 3. Support of Naval Asylum	60,809 00
Sheet No. 4. Repairs and preservation of navy-yards	300,000 00
Sheet No. 5. Improvements at navy-yards	75,000 00
Sheet No. 6. Civil establishment	37,906 25
	946,495 25

I am, very respectfully, your obedient servant,

R. L. LAW,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Bureau of Yards and Docks, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.		
One chief clerk, per act June 19, 1878	$1,800 00	$1,800 00
Draughtsman, and clerk of class four, per act June 19, 1878	1,800 00	1,800 00
One clerk of class four, per act June 19, 1878	1,800 00	1,800 00
One clerk of class three, per act June 19, 1878	1,600 00	1,600 00
One clerk of class two, per act June 19, 1878	1,400 00	1,400 00
One clerk of class one, per act June 19, 1878	1,200 00	1,200 00
One clerk, per act June 19, 1878	1,000 00	1,000 00
One messenger, per act June 19, 1878	720 00	720 00
One laborer, per act June 19, 1878	660 00	660 00
	11,980 00	11,980 00
CONTINGENT EXPENSES.		
Stationery, books, plans, drawings, incidental labor, and miscellaneous items	800 00	800 00
	12,780 00	12,780 00
FOR GENERAL MAINTENANCE.		
For general maintenance of yards and docks, freights and transportation of materials and stores; books, maps, models, and drawings; purchase and repair of fire-engines; machinery and patent right to use the same; repairs of steam-engines and attendance on the same; purchase and maintenance of oxen, horses, and driving teams; carts and timber-wheels for navy-yard purposes; tools, and repairs of the same; postage on letters and other mailable matter on public service, and telegrams; furniture for government houses and offices in navy-yards; coal and other fuel; candles, oil, and gas; cleaning and clearing yards, and care of public buildings; attendance on fires, lights, fire-engines, and apparatus; for clerical and incidental labor at navy-yards; water-tax; tolls and ferriages; pay of watchmen in navy-yards; awnings and packing-boxes for yards and docks purposes	440,000 00	440,000 00
CONTINGENT.		
For contingent expenses that may arise at navy-yards and stations	20,000 00	20,000 00
	460,000 00	460,000 00

Estimates of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
NAVAL ASYLUM, PHILADELPHIA.		
One superintendent	$600 00	$600 00
One steward	480 00	480 00
One matron	360 00	360 00
One cook	240 00	240 00
Two assistant cooks, at $168 each	336 00	336 00
One chief laundress	192 00	192 00
Four laundresses, at $168 each	672 00	672 00
Eight scrubbers and waiters, at $168 each	1,344 00	1,344 00
Six laborers, at $240 each	1,440 00	1,440 00
One stable-keeper and driver	360 00	360 00
One master at arms	480 00	480 00
One corporal	300 00	300 00
One barber	360 00	360 00
One carpenter	845 00	845 00
	8,009 00	8,009 00
For water-rent and gas	2,000 00	2,000 00
For cemetery, burial expenses, headstones, &c	500 00	350 00
For improvement of grounds	500 00	500 00
For furniture, and repairs of same	2,000 00	4,500 00
For repairs to buildings, furnaces, grates, &c	3,900 00	
For car-tickets	100 00	450 00
For increase of library, rebinding books, &c	300 00	....
For support of beneficiaries	43,500 00	45,000 00
	60,809 00	60,809 00
Repairs and preservation at navy-yards	$300,000 00	$300,000 00
NAVY-YARD, MARE ISLAND, CAL.		
For continuation of work on stone dry-dock	75,000 00	75,000 00
NAVY-YARD, PORTSMOUTH, N. H.		
1 clerk	1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
	3,717 25	....
NAVY-YARD, BOSTON, MASS.		
1 clerk	1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
	3,717 25	....
NAVAL STATION, NEW LONDON, CONN.		
1 writer	1,017 25	....
NAVY-YARD, BROOKLYN, N. Y.		
1 clerk	1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
1 writer	939 00	....
1 draughtsman	1,565 00	....
	6,221 25	....
NAVY-YARD, LEAGUE ISLAND, PA.		
1 clerk	1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
1 writer	939 00	....
1 draughtsman	1,565 00	....
	6,221 25	....

Estimates of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
NAVY-YARD, WASHINGTON, D. C.		
1 clerk	$1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
	3,717 25	....
NAVY-YARD, NORFOLK, VA.		
1 clerk	1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
1 writer	939 00	....
	4,656 25	....
NAVY-YARD, PENSACOLA, FLA.		
1 clerk	1,400 00	....
1 writer	1,017 25	....
	2,417 25	....
NAVY-YARD, MARE ISLAND, CAL.		
1 clerk	1,400 00	....
1 clerk	1,300 00	....
1 writer	1,017 25	....
1 writer	939 00	....
1 draughtsman	1,565 00	....
	6,221 25	....
	37,906 25	....

Respectfully submitted.

R. L. LAW,
Chief of Bureau.

ABSTRACT OF OFFERS FOR FURNISHING SUPPLIES FOR THE SEVERAL NAVY-YARDS COMING UNDER THE COGNIZANCE OF THE BUREAU OF YARDS AND DOCKS.

Abstract of offers received for furnishing material for the navy-yard, Portsmouth, N. H., under the cognizance of the Bureau of Yards and Docks, for fiscal year ending 30th June, 1878.

August 25, 1877.—Class No. 16. Ship-chandlery:

John H. Pray, Sons & Co.	*$400 00
Myers & Lucke	489 60
S. C. Carll	525 80

November 12, 1877.—Class No. 15. Paints, oils, and glass:

Rider & Cotton	*$36 03½
G. T. Vaughn	39 15
A. P. Wendell & Co.	41 77
Isaiah Wilson	43 50

November 12, 1877.—Class No. 17. Hardware:

Isaiah Wilton	*$26 26
Rider & Cotton	26 44
G. T. Vaughn	26 73
A. P. Wendell & Co.	30 42

November 12, 1877.—Class No. 20. Hay and straw:

E. C. Spinney	*$691 00
Alvin Libbey	672 00
Benjamin F. Cate	734 00
Stephen Grant	714 00

November 12, 1877.—Class No. 17. Hardware:

G. T. Vaughn	*$9 60

Class No. 17—Continued.

A. P. Wendell & Co.	$10 25
Rider & Cotton	16 30

February 2, 1878.—Class No. 15. Paints, oils, and glass:

Rider & Cotton	*$263 85
G. T. Vaughn	272 00

February 19, 1878.—Class No. 21. Provender:

E. F. Nealley	*$72 00
Charles Robinson & Son	72 00
Lewis & Brooks	73 20

Class No. 27. Anthracite coal:

C. E. Walker & Co	*$1,395 00
L. G. Burnham & Co	1,455 00
E. F. Sise & Co.	1,497 00

Class No. 27. Anthracite coal:

C. E. Walker & Co	*$750 00
L. G. Burnham & Co.	799 50
E. F. Sise & Co.	801 00

Class No. 29. Bituminous coal:

C. E. Walker & Co	$170 00
L. G. Burnham & Co	165 00
E. F. Sise & Co.	180 00

Abstract of offers received for furnishing miscellaneous articles for navy-yard at Portsmouth, N. H., October 16, 1877.

Class No. 1:

Rider & Cotton	†$46 39
Isaiah Wilson	54 28
John P. Sweetser	58 80
A. P. Wendell & Co	378 13

Class No. 2:

E. F. Jewell	†706 00
G. A. Hammond	797 50
Samuel Adams & Co	776 00

Class No. 3:

Samuel Adams & Co	†58 75
C. E. Walker & Co	63 00

Class No. 4:

Rider & Cotton	90 00
Isaiah Wilson	†88 12
John P. Sweetser	96 25
A. P. Wendell, & Co	101 25

Class No. 5:

Rider & Cotton	†$33 20
Isaiah Wilson	41 10
John P. Sweetser	53 00
A. P. Wendell & Co	42 23
G. T. Vaughn	45 75
John H. Bailey	49 37

Class No. 6:

Rider & Cotton	†468 97
Isaiah Wilson	495 86
A. P. Wendell & Co	502 63
John H. Bailey	483 90
C. A. Burgess & Co	530 30

Class No. 7:

Rider & Cotton	†72 78
Isaiah Wilson	82 31
John P. Sweetser	81 50
A. P. Wendell & Co	84 26

* Accepted. † Awarded.

Abstract of offers received for furnishing miscellaneous articles, &c.—Continued.

Class No. 7—Continued.	
G. T. Vaughn	$93 99
N. F. Mathis & Co	98 25
Class No. 8:	
Rider & Cotton	*587 88
John P. Sweetser	671 20
N. F. Mathis & Co	603 25
Class No. 9:	
E. H. Jewell	*18 00
G. A. Hammond	20 00
Samuel Adams & Co	25 00
Class No. 10:	
Rider & Cotton	133 05
Isaiah Wilson	*131 78
John P. Sweetser	147 53
A. P. Wendell & Co	156 33
Class No. 11:	
Rider & Cotton	106 19
Isaiah Wilson	121 35
A. P. Wendell & Co	99 79
G. T. Vaughn	*98 54
Class No. 12:	
Rider & Cotton	193 82
Isaiah Wilson	208 46
A. P. Wendell & Co	*150 10
John H. Bailey	169 00
Class No. 13:	
Rider & Cotton	*99 75
Isaiah Wilson	102 00
John P. Sweetser	100 87
A. P. Wendell & Cotton	100 13
Class No. 14:	
E. M. Brown & Co	*124 33
C. Dwight Hanscom & Co.	130 45
Sheldon Brothers	141 64
Class No. 15:	
John S. Tilton	*81 64
C. A Shannon & Son	104 61
Class No. 16:	
John F. Plaisted	*31 50
Chas. G. Brown	31 50
A. J. McIntire	35 00
Joseph N. Norton	40 25
Class No. 17:	
C. E. Walker & Co	*$2,760 00
E. F. Sise & Co	3,176 25
C. A. Campbell	3,322 00
Class No. 18:	
Rider & Cotton	*322 50
Isaiah Wilson	359 90
A. P. Wendell & Co	412 60
G. T. Vaughn	411 74
N. F. Mathis & Co	359 50
Class No. 19:	
Rider & Cotton	*19 25
Isaiah Wilson	23 25
A. P. Wendell & Co	22 45
G. T. Vaughn	20 72
John H. Bailey	22 40
N. F. Mathis & Co	23 50
Class No. 20:	
Rider & Cotton	*172 35
G. T. Vaughn	174 00
Class No. 21:	
Rider & Cotton	22 18
G. T. Vaughn	*21 65
N. F. Mathis & Co	23 31
Butler & Leighton	25 13
Class No. 22:	
Mercer Goodrich	*70 43
Willis G. Myers	74 81
Hall L. Davis	96 20
Class No. 23:	
Mercer Goodrich	84 65
Willis G. Myers	*78 34
Hall L. Davis	83 43
Class No. 24:	
G. A. Hammond	180 00
E. C. Senney	*169 00
George H. Hayes	200 00
Chas. H. Bartlett	188 70
Timothy Furbish	185 90
Alvin L. Dibbey	184 80
Louis De Rochemont	183 60
E. C. Moody	178 00
C. W. Cottle	179 00

Abstract of offers received for furnishing materials for navy-yard, Boston, Mass.

August 10, 1878.—Class No. 6. Lumber:	
M. M. Tickey	†$510 39
January 3, 1878.—Class No. 15. Glass:	
Lambert Bros	119 40
R. Sherburne	83 08
Page, Harding & Co	74 60
G. D. Putnam & Co	†72 60
March 6, 1878.—Class No. 23. Belting, &c.:	
Ordway, Kimball & Co	$98 27
G. D. Putnam & Co	95 90
French & Coffin	†87 50
June 29, 1878.—Class No. 17. Hardware:	
J. L. Fairbanks & Co	59 72
Stephens Vice Co	†44 50
John Mullett	45 00

*Awarded. †Accepted.

Scale of offers for supplies for the navy-yard, Boston, Mass., September, 27, 1877.

Class No. 5. Oak and hard wood:	
John Trickey	$180 00
James & Abbott	*165 00
Watson & Pittinger	240 00
Class No. 6. White pine, spruce, juniper, and cypress:	
John Trickey	1,460 00
James & Abbott	1,420 00
Watson & Pittinger	1,890 00
Geo. D. Putnam & Co	1,179 20
Class No. 7. Lime, hair, and plaster:	
J. H. Walker	35 00
John H. Trickey	*27 50
John Mullett	30 00
Class No. 8. Cement:	
J. H. Walker	77 50
John Trickey	75 00
John Mullett	*72 00
Class No. 11. Iron, iron nails, and spikes:	
J. H. Walker	*235 62
M. Lissberger	†176 00
Class No. 12. Steel:	
J. H. Walker	*116 25
M. Lissberger	†108 50
Class No. 15. Paints, oils, and glass:	
J. H. Walker	548 07
Geo. D. Putnam & Co	*545 68
M. Lissberger	†469 90
Class No. 16. Ship-chandlery:	
J. H. Walker	*148 85
M. Lissberger	136 10
Class No. 17. Hardware:	
J. H. Walker	*152 55
Class No. 17—Continued.	
M. Lissberger	†$120 35
Class No. 18. Stationery:	
W. H. Dempsey	*271 80
Class No. 20. Hay and straw:	
John Trickey	1,425 00
John Mullett	*1,377 60
L. L. De Rochement	1,470 00
Class No. 21. Provender:	
John Trickey	722 75
John Mullett	*682 50
Class No. 22. Charcoal:	
J. H, Walker	39 75
David Babcock & Co	33 00
George D. Putnam & Co	37 50
John Mullett	*29 25
Class No. 23. Belting, packing, and hose:	
J. H. Walker	223 71
George D. Putnam & Co	*209 25
M. Lissberger	†163 75
Class No. 24. Sperm and lubricating oil:	
J. H. Walker	131 88
David Babcock & Co	129 78
George D. Putnam & Co	*116 76
John Mullett	129 36
Class No. 25. Iron-work, piping, &c.:	
J. H. Walker	*136 70
M. Lissberger	†81 00
Class No. 27. Anthracite coal:	
Samuel G. French	1,820 40
John Street & Co	1,881 00
David Babcock & Co	*1,652 30
George D. Putnam & Co	2,091 00

Abstract of offers received for furnishing materials for the navy-yard, New York, during the fiscal year ending June 30, 1878.

July 25, 1877.—Class No. 6. White pine, spruce, &c.:	
Watson & Pittinger	*$84 00
A. Ammennan	87 50
D. Babcock & Co	87 50
Class No. 2. Stone:	
Brainerd & Fosket	706 35
D. Babcock & Co	*682 20
August 4, 1877.—Class No. 23. Belting, &c.:	
G. H. Creed	134 90
Walton Bros	140 34
D. Babcock	*130 40
Class No. 6. White pine, spruce, &c.:	
Watson & Pittinger	*191 88
Class No. 6—Continued.	
A. Ammennan	$210 00
D. Babcock & Co	202 80
August 20, 1877.—Class No. 8. Cement:	
Brainerd & Fosket	2,260 50
Washburn & Barnes	2,296 80
D. Babcock & Co	*2,138 80
January 23, 1878.—Class No. 4. Lumber:	
D. Babcock & Co	*247 50
Cross, Austin & Co	252 50
February 13, 1878.—Class No. 23. Belting, &c.:	
D. Babcock & Co	*162 23
J. H. Redfield	164 46

* Accepted. † Received too late.

Abstract of offers received for furnishing materials, &c.—Continued.

Class No. 4.—Lumber:	
D. Babcock & Co	$261 83
J. W. Duryee	*259 20
J. H. Redfield	305 00
Class No. 5.—Oak and hard wood:	
J. W. Duryee	90 00
D. Babcock & Co	87 50
J. H. Redfield	*45 00
May 27, 1878.—Class No. 2. Stone:	
D. Babcock & Co	*275 00
Patrick Hanlon	280 00
Brainerd & Fosket	285 00
April 23, 1878:	
Brainerd & Fosket	*328 00
P. Lyman	338 00
D. Babcock & Co	375 00
May 13, 1878:	
L. Kennedy	*635 00
D. Babcock & Co	860 00
H. Stollmyer & Co	910 00
Brainerd & Fosket	700 00
P. Lyman	767 50
C. Hanean	865 00
June 19, 1878:	
F. A. Madden	880 00
M. Smith	960 00
D. Babcock & Co	960 00
J. M. Shannon	*860 00
C. D. Bodine	920 00
June 19, 1878.—Class No. 2. Stone—3 lots:	
F. A. Madden	740 00
D. Babcock & Co	800 00
E. Sweeney	780 00
J. J. Buck	760 00
J. J. Buck	*360 00
E. Sweeney	400 00
D. Babcock & Co	360 00
T. Madden	400 00
F. A. Madden	170 00
D. Babcock & Co	180 00
E. Sweeney	*160 00
J. J. Buck	175 00
E. Sweeney	160 00
J. J. Buck	170 00
D. Babcock & Co	180 00
T. A. Wadden	*150 00
April 23, 1878.—Class No. 32. Machinery and tools:	
F. T. Rowland	*270 00
Clapp & Jones	500 00
Ward, Stanton & Co	1,000 00
May 13, 1878.—Class No. 15. Paints, oils, and glass:	
D. Babcock & Co	400 00
Averill Paint Co	*270 00
Davidson, Houghton & Co	300 00
G. W. Hall	400 00
May 13, 1878.—Class No. 15. Paints, oils, and glass:	
David Babcock & Co	*$174 52
G. W. Hall	178 35
May 13, 1878.—Class No. 15. Paints, oils, and glass:	
Davidson, Houghton & Co	300 00
Averill Paint Company	*270 00
D. Babcock & Co	400 00
George W. Hall	400 00
June 5, 1878.—Class No. 5. Oak and hard wood:	
Watson & Pittinger	176 00
Duryee & Ludlow	*174 00
D. Babcock & Co	195 00
June 5, 1878.—Class No. 5. White pine, &c.:	
Watson & Pittinger	96 00
Duryee & Ludlow	*86 00
D. Babcock & Co	99 00
June 19, 1878.—Class No. 15—Continued:	
D. Babcock & Co	308 00
J. Lucas & Co	280 00
Averill & Co	270 00
National Paint Company	*260 00
June 19, 1878:	
D. Babcock & Co	*263 00
National Paint Company	310 00
Averill Paint Company	335 00
J. Lucas & Co	*40 75
D. Babcock & Co	43 75
June 19, 1878.—Class No. 8. Cement:	
E. Sweeny	*90 00
D. Babcock & Co	105 00
June 19, 1878.—Class No. 17. Hardware:	
D. Babcock & Co	*155 00
J. J. Haely	220 00
W. W. Wooley	175 00
June 19, 1878.—Class No. 4. Lumber:	
D. Babcock & Co	294 00
Duryee & Ludlow	*200 00
Watson & Pittinger	272 00
June 29, 1878.—Class No. 27. Anthracite coal:	
D. Babcock & Co	*2,540 00
S. G. French	2,712 50
A. F. Nathan	2,760 75
James D. Leary	2,679 00
July 26, 1877.—Class No. 27. Anthracite coal:	
Samuel G. French	*1,099 20
J. H. Redfield	1,203 80
J. H. Walker	1,167 50
D. Babcock & Co	1,102 00
James D. Leary	1,196 80

* Accepted.

Scale of offers for supplies for the navy-yard, Brooklyn, N. Y., September 27, 1877.

Class No. 1. Brick:	
David Babcock & Co	*$297 50
J. H. Walker	321 50
Class No. 2½. Stone:	
David Babcock & Co	*1,725 00
Class No. 3. Yellow-pine timber:	
Robert J. Nealley	420 00
W. A. Greenleaf	*330 50
James & Abbott	384 00
Watson & Pittinger	430 00
Class No. 5. Oak and hard wood:	
W. A. Greenleaf	*270 00
James & Abbott	399 00
Watson & Pittinger	605 00
Class No. 6. White pine, spruce, &c.:	
W. A. Greenleaf	*735 00
James & Abbott	898 00
Watson & Pittinger	762 00
Class No. 7. Lime, hair, and plaster:	
David Babcock & Co	47 50
W. A. Greenleaf	*39 00
J. H. Walker	41 75
Class No. 8. Cement:	
David Babcock & Co	*63 00
W. A. Greenleaf	80 00
James D. Peck, treasurer	90 00
J. H. Walker	85 50
Class No. 9. Gravel and sand:	
David Babcock & Co	401 00
J. H. Walker	*384 50
Class No. 9½. Molding and fire sand and fire-clay:	
David Babcock & Co	*13 00
J. H. Walker	13 75
Class No. 11. Iron, iron spikes, and nails:	
David Babcock & Co	880 80
W. A. Greenleaf	803 45
Bellah, Quigley & Co	*732 46
George H. Creed	770 30
J. H. Walker	785 75
M. Lissberger	†677 00
Class No. 12. Steel:	
David Babcock & Co	152 00
W. A. Greenleaf	153 00
Bellah, Quigley & Co	*114 00
George H. Creed	132 00
J. H. Walker	164 00
Class No. 14. Files:	
H. H. Wright	80 71
W. A. Greenleaf	113 80
James D. Peck, treasurer	88 40
Bellah, Quigley & Co	108 15
J. W. Gaskill & Sons	95 57
Class No. 14—Continued.	
George H. Creed	*$70 57
J. H. Walker	75 96
M. Lissberger	87 85
Class No. 15. Paints, oils, and glass:	
David Babcock & Co	1,313 15
Robert J. Nealley	1,424 70
James D. Peck, treasurer	1,320 70
E. A. Boyd	1,409 94
Bellah, Quigley & Co	1,349 65
E. F., J. E., & H. Holbrook	1,284 00
George H. Creed	*1,232 75
J. H. Walker	1,309 60
M. Lissberger	1,365 25
Class No. 16. Ship chandlery:	
David Babcock	*964 26
J. H. Walker	1,083 94
M. Lissberger	†765 09
Class No. 17. Hardware:	
J. H. Walker	*581 44
M. Lissberger	†469 95
Class No. 18. Stationery:	
Arthur & Bonnell	498 69
W. H. Dempsey	*458 50
Class No. 20. Hay and straw:	
E. R. Shipman	*1,587 00
Class No. 21. Provender:	
E. R. Shipman	*1,507 50
Class No. 22. Charcoal:	
David Babcock & Co	*$36 00
J. H. Walker	36 75
Samuel G. French	45 00
Class No. 23. Belting, packing, and hose:	
George H. Creed	153 00
J. H. Walker	*144 60
Class No. 24. Sperm and lubricating oils:	
David Babcock & Co	*106 40
James D. Peck, Treasurer	113 60
George H. Creed	106 40
J. H. Walker	126 40
Class No. 25. Iron-work, piping, &c.:	
H. J. Davidson	356 41
George H. Creed	*303 40
J. H. Walker	325 44
Class No. 26. Augers:	
J. H. Walker	*11 10
Class No. 27. Anthracite coal:	
David Babcock & Co	*2,338 00
John Street & Co	2,557 50
George H. Creed	2,583 00
J. H. Walker	2,740 50
Samuel G. French	2,375 10

* Accepted. † Received too late.

Abstract of offers received for furnishing materials for the navy-yard, League Island, Pa., under cognizance of the Bureau of Yards and Docks, for the fiscal year ending June 30, 1878.

Class No. 30. Semi-bituminous Broad Top coal:	
David Babcock	$450 00
J. H. Walker	*300 00
Samuel G. French	337 50
February 21, 1878.—Class No. 4. Lumber:	
J. W. Gaskill & Sons	*$92 50
E. B. Edwards	99 00
J. Warner & Co	95 80
February 21, 1878.—Class No. 15. Paints, oils, and glass:	
United States White Lead Co	62 20
C. H. Howell	*57 50
W. Waterall & Co	59 60
March 21, 1878.—Class No. 18. Stationery:	
W. F. Murphy & Sons	*15 40
Walstrom & Stevens	16 30
March 21, 1878.—Class No. 20. Hay and straw:	
D. Landreth & Sons	*22 50
Robert Buist	35 00
April 4, 1878.—Class No. 4. Lumber:	
J. W. Gaskill & Sons	*45 00
E. B. Edwards	46 00
April 18, 1878.—Class No. 17. Hardware:	
J. B. Shannon & Son	*163 16
Paul J. Field	167 36
J. F. Gaskill	189 27
May 4, 1878.—Class No. 15. Paints, oils, and glass:	
C. H. Howell	36 50
Ward & Co	36 00
B. H. Shoemaker & Son	*31 50
May 4, 1878.—Class No. 12. Hardware:	
Paul J. Field	*12 35
J. B. Shannon & Sons	12 98
D. Landreth & Sons	21 20
February 25, 1878.—Class No. 15. Paints, oils, and glass:	
United States White Lead Company	62 20
William Waterall & Co	59 60
C. H. Howell & Co	*57 50
February 25, 1878.—Class No. 5. Oak and hard wood:	
J. W. Gaskill & Sons	*92 50
F. V. Warner & Co	95 80
E. B. Edwards & Co	99 00
March 29, 1878.—Class No. 18. Stationery:	
Walstrom & Stevens	$16 30
W. F. Murphy & Sons	*15 90
Robert Burst & Co	
March 29, 1878.—Class No. 21. Provender:	
Robert Burist, jr	35 00
D. Landreth & Sons	*26 95
P. B. Mingle & Co	31 25
April 24, 1878:	
Paul J. Field	$167 36
J. B. Shannon	*163 16
J. Frank Gaskill	189 27
May 10, 1878.—Class No. 15. Paints, oils, &c.:	
C. H. Howell & Co	36 50
B. H. Shoemaker	31 50
Ward & Co	36 00
May 10, 1878.—Class No. 17. Hardware:	
Paul J. Field	*12 35
J. B. Shannon	12 98
D. Landreth & Sons	21 20
May 10, 1878.—Class No. 18. Stationery:	
J. E. Magee & Co	*10 96
W. F. Murphy & Sons	8 50
Malstrom & Stevens	15 50
May 18, 1878.—Class No. 17. Hardware:	
B. H. Shoemaker	42 04
J. B. Shannon & Sons	*41 50
Paul J. Field	42 50
June 29, 1878.—Class No. 4. Lumber:	
J. W. Gaskill & Sons	*200 00
E. B. Edwards	240 00
E. P. Moore	210 00
June 29, 1878.—Class No. 15. Paints, oils, and glass:	
U. S. White Lead Co	34 46
W. Waterall & Co	34 20
C. H. Howell & Co	*34 08
June 29, 1878.—Class No. 25. Iron-work, piping, &c.:	
Weaver & Pennock	105 33
Brodie & Comfort	92 00
C. A. Blessing	*70 00
June 29, 1878.—Class No. 11. Iron, iron nails, &c.:	
Paul J. Field	*23 05
J. B. Shannon & Sons	24 05
Noblitt, Brown, Noblitt & Co	

*Accepted.

Abstract of offers received for furnishing materials, &c.—Continued.

May 10, 1878.—Class 15. Paints, oils, and glass:	
F. S. Pease	*$48 00
E. S. Street	20 00
A. T. Beam	42 00
August 12, 1878.—Class No. 23. Belting, packing, and hose:	
Eureka Fire Hose Co	3,000 00
Walton Bros	2,850 00
R. Lerick Son & Co	*2,595 00
August 12, 1878.—Class No. 5. Oak and hard wood:	
Francis Wessels	1,117 20
Barrett, Garrison & Co	1,368 00
J. W. Gaskill & Son	1,037 00
J. and C. Stockham	*684 00
August 12, 1878.—Class No. 4. Lumber:	
J. W. Gaskill & Son	*4,100 86
J. and C. Stockham	5,125 00
August 12, 1878.—Class No. 17. Hardware:	
Paul J. Field	*63 00
J. F. Gaskill	66 00
September 2, 1878.—Class No. 4. Lumber:	
Wessells, McClane & Co	*$590 30
W. N. Shakespeare	757 00
J. W. Gaskill & Sons	621 25
A. Lewis & Co	770 00
E. P. Burton	725 00
R. S. McKay	906 00
No name	805 00
September 2, 1878.—Class No. 5. Oak and hard wood:	
Wessels, McClane & Co	1,484 75
W. N. Shakespeare	1,738 00
J. W. Gaskill & Sons	*1,421 50
A. Lewis	2,040 00
E. P. Burton	1,815 00
R. S. McKay	2,343 00
No name	1,907 50
September 2, 1878.—Class No. 27. Coal:	Per ton.
W. P. Street	4 80
Geo. B. Newton & Co	*4 65
Campbell, Tucker & Co	4 67

Scale of offers for supplies for the navy-yard, League Island, Pa., September 27, 1877.

Class No. 6. White-pine lumber:	
Watson & Pittinger	$405 00
J. W. Gaskill & Sons	*263 50
Class No. 16. Ship-chandlery:	
J. H. Walker	*775 65
J. B. Shannon	801 23
Paul J. Field	860 00
M. Lissberger	†535 55
† Received too late.	
Class No. 17. Hardware:	
J. H. Walker	659 78
J. B. Shannon	*598 65
Chas. J. Field	626 77
J. W. Gaskill & Son	695 45
Paul J. Field	716 64
M. Lissberger	†352 84
Class No. 18. Stationery:	
W. H. Dempsey	*829 31
J. B. Shannon	852 03
Class No. 20. Hay:	
A. A. McCullough	590 00
J. B. Shannon	599 40
Paul J. Field	560 00
Class No. 21. Provender:	
A. A. McCullough	41,907 50
J. B. Shannon	*755 50
J. B. Canby	$863 00
Paul J. Field	903 00
Class No. 23. Belting, packing, and hose:	
J. H. Walker	*117 00
J. B. Shannon	176 00
Paul J. Field	250 00
M. Lissberger	†94 00
Class No. 24¼. Illuminating oils:	
J. B. Shannon	300 00
Class No. 25. Iron-work, piping, &c.:	
J. H. Walker	148 65
J. B. Shannon	*122 63
J. W. Gaskill & Sons	147 22
M. Lissberger	†110 68
Class No. 27. Anthracite coal:	
A. A. McCullough	*2,725 00
Samuel G. French	2,870 00
John Street & Co	3,150 00
Class 29. Bituminous Cumberland coal:	
A. A. McCullough	300 00
Samuel G. French	300 00
John Street & Co	*237 50

* Accepted. † Received too late.

Scale of offers for supplies for the Naval Asylum, Philadelphia, September 27, 1877.

Class No. 1. Clothing:	
Wannamaker & Brown	*$1,715 00
Jacob Reed & Sons	4,883 80
Class No. 2. Boots and shoes:	
William McKnight	2,007 50
Wannamaker & Brown	1,856 25
Class No. 3. Provisions:	
Joseph Comey & Sons	*8,289 00
Gottlieb Schiedt	9,880 20
John J. Griffith	9,848 20
Henry Jahke	9,334 50
Class No. 4. Groceries:	
Samuel Hill	7,349 64
Robert McKeown	*6,618 93
Class No. 5. Dry goods:	
Wannamaker & Brown	*613 53
Paul J. Field	770 85
Noblitt, Brown, Noblitt & Co	623 48
Class No. 6. Bread:	
William Boschy	1,824 00
J. F. Widmayer	1,836 00
Gustav Menzel	*1,409 00
John McIlwain	1,830 00
Lewis Ortman	1,636 00
Class No. 7. Tobacco:	
J. Rinaldo Sank & Co	1,104 00
Paul J. Field	*1,081 00
Class No. 8. Coal and wood:	
W. F. Moody	*$1,604 00
Class No. 9. Paints, oils, and glass:	
J. B. Shannon	530 61
J. W. Gaskill & Sons	523 20
Paul J. Field	580 35
Bellah, Quigley & Co	*480 30
Jos. D. Peck, president	545 51
William Waterall & Co	493 00
Class No. 11. Lumber:	
Lemuel Bannister	661 50
J. W. Gaskill & Sons	587 25
Class No. 13. Provender:	
J. B. Shannon	*145 50
Paul J. Field	154 00
Class No. 14. Miscellaneous:	
J. B. Shannon	1,407 17
Paul J. Field	592 47
Noblitt, Brown, Noblitt & Co	*529 12
Class No. 15. Hardware:	
J. B. Shannon	259 39
Paul J. Field	259 57
Noblitt, Brown, Noblitt & Co	*235 03
Charles J. Field	262 27

Abstract of offers received for furnishing materials for navy-yard, Washington, D. C.

June 28, 1877.—Class No. 21. Provender:	
John A. Baker	$1,485 90
O. E. Hine	*1,420 00
J. D. Cumming	1,809 23
A. E. Phillips	1,613 50
September 8, 1877.—Class No. 17. Hardware:	Per lb.
C. G. Schneider	03¼
L. C. Campbell	*03
Class No. 17. Hardware:	
L. H. Schneider	*$41 00
C. G. Schneider	51 25
L. C. Campbell	45 25
September 11, 1877.—Class No. 17. Hardware:	
Robert Boyd	*6 75
George P. Goff	10 40
October 4, 1877.—Class No. 8. Cement:	
L. W. Guinand	*165 25
John Berry	262 10
W. H. & E. H. Godey, agt's.	210 75
Class No. 6. Lumber, &c.:	
L. W. Guinand	1,384 10
Class No. 6—Continued.	
A. A. McCullough	$1,798 00
W. W. McCullough	*1,382 90
Thomas Banks & Co	1,558 65
Austin P. Brown	1,815 00
Thomas P. Morgan	2,937 50
H. W. Blunt	2,480 00
Class No. 17. Hardware:	
T. M. Shepherd	*116 02
R. G. Campbell	133 55
Joseph L. Savage	120 45
Class No. 17. Hardware:	
R. G. Campbell	172 88
T. M. Shepherd	*107 95
George W. Goodall	122 40
Joseph L. Savage	114 95
November 1, 1877.—Class No. 22. Charcoal:	Per bu.
B. Wayne	10 cts.
W. T. Clarke	10 cts.
J. V. Trumbull	*9⅕ cts.
December 15, 1877.—Class No. 3. Timber, &c.:	Lin. foot.
W. W. McCullough	10 cts.
Thomas Banks & Co	*8 cts.

*Accepted.

Abstract of offers received for furnishing materials, &c.—Continued.

February 16, 1878.—Class No. 3. Timber, &c.:

	Per M. B. M.
E. W. Willis	$20 00
Thomas Banks & Co	24 00
W. W. McCullough	*30 00

April 6, 1878.—Class No. 29. Cumberland coal:

	Per ton.
George Bogus	3 21
T. W. Riley & Sons	*2 94
Stephenson Bros	2 99
Samuel Emery	3 20
L. W. Guinand	3 00
John Spencer	3 12
J. B. Cross	3 13

May 7, 1878.—Class No. 8. Cement:

W. Nottingham & Co	154 00
Acker & Co	208 00
L. W. Guinand	152 00
P. Maloney	*137 00

May 13, 1878.—Class No. 16. Ship-chandlery:

B. Koch	111 00
J. S. Topham	77 50
Thos. Norfleet & Co	*71 50

May 18, 1878.—Class No. 6. Lumber, &c.:

Willett & Libby	751 60
A. P. Brown	840 00
G. A. Shehan	770 00
Cottrell Bros	902 00
T. B. Cross, jr	845 00
T. W. Smith	754 10
Windsor & Grayson	872 50
Smith & Wimsatt	730 50
W. W. McCullough	*726 00

May 24, 1878.—Class No. 8. Stationery:

W. H. Dempsey	*237 55
Solomon & Chapman	253 44

May 29, 1878.—Class No. 25. Iron-work, piping, &c.:

Reuter & Mallory	135 19
Austin P. Brown	183 78
George P. Goff	173 00
T. Somerville	164 19
T. M. Shepherd	168 68
R. Leitch & Sons	136 97

Class No. 25—Continued.

Walton Bros	$651 74
H. Lissberger	*116 65

Class No. 21. Provender:

L. W. Guinand	90 35
A. P. Brown	92 00
Z. D. Gilman	77 30
F. Miller	81 60
H. Lissberger	*69 65

Class No. 15. Paints, oil, and glass:

F. O. Peirce & Co	840 53
George Ryneal	911 85
A. P. Brown	862 39
George P. Goff	872 16
Bellah Quigley & Co	842 12
Z. D. Gilman	834 29
T. M. Shepherd	910 98
J. H. Peake & Co	970 90
Francis Miller	866 94
Martin & Butler	859 66
Walton Bros	860 62
H. Lissberger	*825 45

Class No. 17. Hardware:

R. Boyd	258 85
A. P. Brown	*205 22
George P. Goff	269 91
C. Schneider	252 18
T. M. Shepherd	297 00
Walton Bros	337 74
H. Lissberger	232 00

May 24, 1878.—Class No. 17. Hardware:

L. C. Campbell	307 41
L. H. Schneider	316 62
Geo. P. Goff	*301 83

Class No. 16. Ship-chandlery:

M. G. Copeland & Co	81 10
Hooe Bro. & Co.	70 80

Class No. 17. Hardware:

Thompson & Co.	20 75
S. H. Hopkin	*19 75
A. P. Brown	*324 19
A. W. Kennedy & Co.	355 50

October 4, 1877.—Services for driving piles:

Thos. Banks & Co.	*737 00
Thos. P. Morgan	1,178 00

Abstract of materials for the Norfolk navy-yard for the fiscal year ending June 30, 1878.

July 10, 1877.—Class No. 20. Hay and straw:

W. Schroeder	*$426 75
C. A. Nash	437 45
Geo. Reid	437 50
A. A. McCullough	429 60

February 21, 1877.—Class No. 4. Lumber:

A. A. McCullough	$581 50
Peters Bros.	604 00

*Accepted.

Abstract of materials for the Norfolk navy-yard, &c.—Continued.

June 24, 1877.—Class No. 15. Paints, oils, and glass:	
M. A. & C. A. Santos	*$719 00
E. V. White & Co	725 00
J. M. Butt	738 00
June 28, 1878.—Class No. 8. Cement:	
A. A. McCullough	*1 75
J. O. Gamage	1 85
H. P. Worcester	1 90
August 15, 1877.—Class No. 17. Hardware:	
Alexander & Powell	†60 00
J. R. Gillett	127 00
D. S. Cheny	130 00
August 15, 1877. Ship-chandlery:	
H. Wertheimer	*108 00
S. A. Stevens & Co	110 00
J. Turnbull	†105 00
August 17, 1877.—Class No. 17. Hardware:	
D. S. Cheny & Co	$130 00
G. L. Crow	85 00
J. R. Gillett	127 00
Alexander & Powell	*60 00
August 17, 1877.—Class No. 16. Ship chandlery:	
S. S. Stevens	110 00
H. Wertheimer	*108 00
Jno. Trumbull	†99 00
W. B. Moses	120 00
October 15, 1877.—Class No 17. Hardware:	
Geo. L. Crow	*14 00
J. R. Gillett	17 75
September 1, 1877.—Class No. 17. Hardware:	
Taylor, Elliot, & Watters	*22 00
E. V. White & Co	26 50

Scale of offers for supplies for the navy-yard, Norfolk, Va., September 27, 1877.

Class No. 4. Yellow pine lumber:	
R. J. Nealley	$1,475 00
J. W. Gaskill & Sons	1,673 75
Peters Bros	1,746 25
A. McCullough	*1,368 00
Watson & Pittinger	1,965 00
Class No. 5. Oak and hard wood:	
R. J. Nealley	*384 40
A. A. McCullough	393 50
Watson & Pittinger	537 90
Class No. 6. White pine, spruce, juniper, and cypress:	
R. J. Nealley	182 50
J. W. Gaskill & Sons	197 50
A. A. McCullough	*182 00
Watson & Pittinger	330 00
Class No. 7. Lime, hair, and plaster:	
J. H. Walker	170 00
Peters Bros	121 80
A. A. McCullough	*114 20
Class No. 8. Cement:	
J. H. Walker	119 70
Peters Bros	135 45
David Babcock & Co	*113 40
A. A. McCullough	124 74
Class No. 10. Slate:	
J. H. Walker	*399 80
David Babcock & Co	612 50
A. A. McCullough	512 50
Class No 11. Iron, iron nails, and spikes.	
J. H. Walker	$357 23
J. W. Gaskill & Sons	352 49
E. V. White & Co	362 49
Bellah, Quigly & Co	*339 41
Class No. 12. Steel:	
J. H. Walker	17 25
E. V. White & Co	7 13
Bellah, Quigly & Co	*5 25
Class No. 14. Files:	
J. H. Walker	*46 40
J. W. Gaskill & Sons	64 46
E. V. White & Co	69 74
C. H. Wight	52 07
Class No. 15. Paints, oils, and glass:	
J. H. Walker	943 89
J. W. Gaskill & Sons	961 61
E. F. Holbrook & Co	†227 15
E. V. White & Co	1,087 43
Bellah, Quigley & Co	*927 20
Class No. 16. Ship chandlery:	
J. H. Walker	*338 02
Class No. 17. Hardware:	
J. H. Walker	*728 08
J. W. Gaskill & Sons	772 48
Bellah, Quigley & Co	803 92
Class No. 18. Stationery:	
W. H. Dempsey	*209 77
Arthur & Bonnell	256 30

*Accepted. †Informal.

Scale of offers for supplies for the navy-yard, Norfolk, Va., &c.—Continued.

Class No. 20. Hay and straw:	
R. J. Nealley	$1,768 80
Peters Bros	*1,533 80
A. A. McCullough	1,550 00
Wm. Schroeder	1,630 50
Class No. 21. Provender:	
R. J. Nealley	1,547 50
Peters Bros	*1,490 00
A. A. McCullough	1,579 40
W. Schroeder	1,503 00
Class No. 23. Belting, packing, and hose:	
J. H. Walker	*263 20
E. V. White & Co	365 60
Class No. 24. Sperm and lubricating oil:	
J. H. Walker	124 00
E. V. White & Co	123 20
David Babcock & Co	*115 20
Class No. 25. Iron-work, piping, &c.:	
J. H. Walker	*$114 82
J. W. Gaskill & Sons	135 31
E. V. White & Co	118 26
Class No. 26. Augers:	
J. H. Walker	*22 78
J. W. Gaskill & Sons	37 98
E. V. White & Co	31 05
Class No. 31. Copper and composition nails:	
J. H. Walker	1,074 00
J. W. Gaskill & Son	927 20
E. V. White & Co	*875 50
David Babcock & Co	926 00
Class No. 32. Machinery and tools:	
J. H. Walker	203 77

Scale of offers for supplies for the Navy-Yard, Pensacola, Fla., September 27, 1877.

Class No. 6. White pine, spruce, juniper, and cypress:	
George H. O'Neal	*$90 00
J. O. Neal	120 00
Class No. 7. Lime, hair, and plaster:	
George H. O'Neal	115 00
M. Triestra	*74 00
J. O. Neal	100 00
Class No. 11. Iron, iron spikes, and nails:	
George H. O'Neal	185 00
M. Triestra	139 00
J. O. Neal	155 00
C. McKenzie Oerting	*132 00
Class No. 14. Files:	
George H. O'Neal	47 00
M. Triestra	*22 50
J. O. Neal	60 00
C. McKenzie Oerting	28 40
Class No. 15. Paints, oils, and glass:	
James D. Peck, President	1,404 85
Samuel M. Todd	*1,383 50
M. Triestra	1,653 75
J. O. Neal	1,676 00
C. McKenzie Oerting	1,569 75
Class No. 16. Ship chandlery:	
J. O. Neal	361 25
Class No. 16—Continued.	
C. McKenzie Oerting	$345 15
Class No. 17. Hardware:	
J. O. Neal	430 40
C. McKenzie Oerting	*369 19
Class No. 18. Stationery:	
W. H. Dempsey	*235 82
Arthur & Bonnell	357 19
George W. Turton	356 11
Gamaliel Bell	336 34
Class No. 20. Hay:	
George H. O'Neal	*470 40
M. Triestra	480 00
J. O. Neal	544 00
Class No. 21. Provender:	
George H. O'Neal	891 00
M. Triestra	*687 50
J. O. Neal	700 00
Class No. 24. Sperm and lubricating oil:	
George H. O'Neal	642 00
James D. Peck, Treasurer	*404 00
M. Triestra	502 00
J. O. Neal	516 00
C. McKenzie Oerting	462 00
Class No. 32. Machinery and tools:	
J. O. Neal	37 50
C. McKenzie Oerting	*16 60

*Accepted.

Abstract of offers for removing floating gate and cleaning out dock-basin at Pensacola, Fla., dated June 10, 1878.

Francis Walsh	$3,650 00	S. S. Haney	1,760 00
J. O. Neal	1,150 00	W. E. Anderson	2,875 00
Samuel Glass	2,500 00	Hugh McHatten	1,340 00
S. C. Cobb	2,750 00	W. Hughes	*925 00
George W. Le Gallais	2,400 00	Jasper Gonzales	1,700 00
G. E. Wenthworth	4,183 00		

Abstract of offers for furnishing supplies for the navy-yard, Pensacola, Fla., for the fiscal year ending June 30, 1878.

April 18, 1878.—Class No. 17. Hardware:

McKenzie, Oerting & Co	*$17 25	J. O. Neal	$22 50

April 18, 1878.—Class No. 15. Paints, oils, and glass:

McKenzie, Oerting & Co	*43 50	J. O. Neal	44 00

Abstract of offers for furnishing supplies for the navy-yard, Mare Island, Cal., for the fiscal year ending June 30, 1878.

September 15, 1877.—Class No. 15. Paints, oils, and glass:

A. C. Dietz & Co	*$944 50	Sullivan, Kelly & Co	$972 00
Whittier, Fuller & Co	948 00		

Scale of offers for supplies for the navy-yard, Mare Island, Cal., September 27, 1877.

Class No. 1. Bricks:

W. Walker	$410 00
A. Powell	475 00
F. B. Taylor	*402 56

Class No. 3. Oregon pine timber:

A. Powell	$110 00
James & Abbott	110 00
G. A. Meigs, president	*100 00

Class No. 4. Oregon pine lumber:

W. Walker	$461 00
A. Powell	399 00
James & Abbott	420 00
G. A. Meigs, president	*322 00

Class No. 6. White pine and redwood:

W. Walker	$1,190 50
A. Powell	906 50
James and Abbott	955 95
G. A. Meigs, president	*778 25

Class No. 7. Lime, hair and plaster:

W. Walker	16 00
A. Powell	15 00
James E. Gordon	*7 00

Class No. 8. Cement:

W. Walker	$150 00
A. Powell	135 00
F. B. Taylor	111 25
James E. Gordon	*105 00

Class No. 11. Iron, iron spikes and nails:

J. H. Walker	352 50
James E. Gordon	*186 00

Class No. 14. Files:

J. H. Walker	*171 26
C. H. Wight	188 89
James E. Gordon	201 61

Class No. 15. Paints, oils, and glass:

J. H. Walker	1,165 10
Whittier, Fuller & Co.	1,041 65

Class No. 16. Ship chandlery:

J. H. Walker	406 15
James E. Gordon	*362 91

Class No. 17. Hardware:

J. H. Walker	1,018 43
James E. Gordon	*709 16

* Accepted.

Scale of offers for supplies for the navy-yard, Mare Island, Cal., &c.—Continued.

Class No. 18. Stationery:	
W. H. Dempsey	$284 45
L. H. Bonestell	*270 38
Class No. 22. Charcoal:	
W. Walker	*140 00
A. Powell	250 00
Jas. McCudden	180 00
James E. Gordon	150 00
Class No. 23. Belting, packing, and hose:	
J. H. Walker	210 00
James E. Gordon	*169 00
Class No. 24. Sperm and lubricating oils:	
F. B. Taylor	*$4,792 00
V. G. Schofield	5,002 00
Class No. 25. Iron-work, piping, &c.:	
J. H. Walker	*246 23
Class No. 29. Coal:	
W. Walker	2,100 00
A. Powell	2,075 00
Jas. McCudden	*1,929 20

* Accepted.

No. 7.

BUREAU OF MEDICINE AND SURGERY.

NAVY DEPARTMENT,
BUREAU OF MEDICINE AND SURGERY, *Oct.* 29, 1878.

SIR: In compliance with your order of the 21st instant, I have the honor to submit the annual report of this bureau, with estimates for the support of the medical department of the Navy for the fiscal year ending June 30, 1880. The usual statistics, and a statistical report of the health of the Navy, for the year ending December 31, 1877, are appended. The general health of the Navy has been good, yet from some unknown cause a slight increase in the percentage of sickness as compared with the previous year is apparent. The increased death-rate is due to the loss of the Huron.

The various squadrons, stations, and hospitals have been amply supplied with everything essential for the care and treatment of the sick, and the officers under whose care the sick of the Navy have been placed have performed their duties to the satisfaction of the bureau.

The requirements of the several hospitals were fully represented in the last annual report, and I am pleased to report that a more liberal appropriation by Congress has enabled the bureau to make many needed repairs. At the hospital at Norfolk, so important and so long neglected, some improvements can be made. Drawings and specifications for heating this institution by steam are now before the bureau.

The hospital at Annapolis, as required by the act of May 4, 1878, has been closed, and arrangements are now being made to transfer the furniture to Norfolk and other hospitals. Sufficient furniture, however, will be retained at Annapolis to accommodate the sick, should an unexpected development of disease occur.

NAVAL HOSPITAL FUND.

The condition of this fund is as follows:

Balance on hand October 1, 1877	$860 82
Transferred to the credit of the fund in settlement of accounts by the Fourth Auditor, from October 1, 1877, to October 1, 1878	77,327 20
Credited by appropriation for the fiscal year ending June 30, 1879	50,000 00
Total	128,188 02
Deduct amounts expended from October 1, 1877, to October 1, 1878	80,441 77
Balance on hand October 1, 1878	47,746 25

As you are aware, the support of the hospital establishment depends upon this fund, and that it requires about $100,000 annually to maintain it in its present state. From $30,000 to $40,000 have been received annually from the officers and men of the Navy, as provided in sections 1614 and 4812 of the Revised Statutes; consequently an appropriation under the above head of at least $60,000 will hereafter be required.

ASSISTANT SURGEONS.

At present six vacancies exist in the list of assistant surgeons, the increase over the previous year being due to deaths. The board for the examination of candidates for admission into the Medical Corps has been continuously in session during many years, but as yet has not been able to recommend the number of qualified candidates allowed by law. It is hoped, however, that within another year the corps will be complete, as superior applicants are more frequent than in former years; the result of a higher standard of medical education throughout the country.

There are at present 21 acting assistant surgeons in the service, 5 of whom are employed. As recommended in your last annual report to Congress, under "Volunteer assistant surgeons," the services of this class of officers can be dispensed with. In accordance with your recommendation upon this subject, the House of Representatives was pleased to pass "A bill to abolish the Volunteer Navy."

APOTHECARIES.

The House of Representatives, at its last session, was also pleased to pass a bill entitled "An act to authorize the appointment of apothecaries as warrant-officers in the United States Navy." Your attention is specially invited to this bill, as its approval by the Senate is earnestly desired by the bureau. Should it become a law, great benefit to the service will result.

I am pleased to announce that the instruction afforded to assistant surgeons previous to their examination for promotion at the Naval Hospital, New York, inaugurated by my predecessor, has been in every regard highly beneficial to the interests of the service, and reflects great credit upon its originator, as also upon those engaged as instructors.

The Book of Instructions for Medical Officers, referred to in the last annual report of this bureau, is now ready for distribution, with such changes as have become necessary since the last issue in 1873.

A second number of Medical and Sanitary Reports (1875 to 1878) was in course of preparation when the act forbidding publications without authority of Congress was passed. This work, as you are aware, consists of the reports of medical officers, at home and abroad, on subjects of deep interest to the Navy and the profession at large. In anticipation of its publication, the bureau is constantly in receipt of communications from the profession and others, requesting copies, which is in itself evidence of its importance and value.

A report of surgical casualties in the Navy from 1860 to 1870, prepared with labor and expense, remains unpublished. It contains a vast amount of experience, and would be of value to the Navy and profession. Your assistance to procure the necessary legislation to enable the bureau to publish this and the preceding work is earnestly solicited.

The atmospheric observations on board our vessels of war, referred to in last report, are now in successful operation, and form a part of the regular reports to this bureau required of medical officers. At a later period it is probable a special report will be made to you upon this subject.

The number of letters from the Hon. Commissioner of Pensions, addressed to this bureau, increases with each year, and this leads me to invite attention to a bill introduced in the House of Representatives March 11, 1876 (2590). Its provisions, as amended by its author, are briefly as follows: That the Bureau of Pensions shall be transferred from the Department of the Interior to the Departments of War and Navy, respectively, and that the duties now performed by the Commissioner of Pensions, so far as relates to the Navy, shall be performed by the Chief of Bureau of Medicine.

This bill appears to the bureau to be alike in the interest of the government and pensioner. It would obviate the delay now unavoidable in the preparation of records for the Commissioner, assist the deserving claimant, and enable the department to promptly dispose of undeserving and fraudulent claims. The Bureaus of Navigation, Equipment and Recruiting, and Medicine and Surgery, contain all the information on file, and should additional evidence at any time be required, it could be promptly obtained by the department from its officers ashore or afloat.

The bill further provides that all examinations shall be made by medical officers of the Navy, and that all payments shall be made by pay-officers of the same service. That this system would not only insure fidelity and efficiency, but the saving to the government annually of large sums of money, must be apparent.

It is hoped your views on this subject may accord with those of the bureau, and that the attention of Congress will be called to it at an early day.

Very respectfully, your obedient servant,

J. WINTHROP TAYLOR,
Surgeon-General, U. S. N.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880 by the Bureau of Medicine and Surgery.

Detailed objects of expenditure and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.		
For one chief clerk, per act June 19, 1878 (20 Stat. at L., p. 198, sec. 2; Rev. Stats., p. 70, sec. 416)	$1,800 00	
For one clerk class three, per act June 19, 1878 (20 Stat. at L., p. 198, sec. 2; Rev. Stats., p. 26, sec. 167)	1,600 00	
For one clerk, per act June 19, 1878 (20 Stat. at L., p. 198, sec. 2)	1,000 00	
For one assistant messenger, per act June 19, 1878 (20 Stat. at L., p. 198, sec. 2)	720 00	
For one laborer, per act June 19, 1878 (20 Stat. at L., p. 198, sec. 2)	640 00	
	5,780 00	$5,780 00
CONTINGENT EXPENSES.		
For stationery and miscellaneous items	100 00	100 00
MEDICAL DEPARTMENT.		
For support of the medical department, for surgeons' necessaries for vessels in commission, navy-yards, naval stations, Marine Corps, and Coast Survey (appropriated May 4, 1878, 20 Stat. at L., p. 53, sec. 1)	45,000 00	45,000 00
NAVAL HOSPITAL FUND.		
For maintenance of the naval hospitals at Portsmouth, N. H.; Chelsea, Mass.; Brooklyn, N. Y.; Philadelphia, Pa.; Annapolis, Md.; Washington, D. C.; Norfolk, Va.; Pensacola, Fla.; Mare Island, Cal., and Yokohama, Japan (appropriated May 4, 1878, 20 Stat. at L., p. 53, sec. 1)	50,000 00	50,000 00
CONTINGENT.		
For contingent expenses of the bureau, for freight on medical stores, transportation of insane patients to the government hospital, advertising, telegraphing, purchase of books, expenses attending the medical board of examiners, purchase and repair of wagons, harness; purchase and feed of horses, cows; trees, garden tools and seeds (appropriated May 4, 1878, 20 Stat. at L., p. 53, sec. 1)	15,000 00	15,000 00
REPAIRS OF HOSPITALS, ETC.		
For repairs to naval laboratory, naval hospitals and appendages, including roads, wharves, outhouses, sidewalks, fences, gardens, farms, cemeteries &c. (appropriated May 4, 1878, 20 Stat. at L., p. 53, sec. 1)	30,000 00	30,000 00
CIVIL ESTABLISHMENT OF HOSPITALS AND YARDS.		
For pay of employés at the several naval hospitals, navy-yards, naval laboratory, and Naval Academy, under the cognizance of the Bureau of Medicine and Surgery (appropriated May 4, 1878, 20 Stat. at L., p. 53, sec. 1)	40,000 00	40,000 00
RECAPITULATION.		
Medical department	45,000 00	45,000 00
Naval hospital fund	50,000 00	50,000 00
Contingent	15,000 00	15,000 00
Repairs of hospitals, &c	30,000 00	30,000 00
Civil establishment of hospitals and yards	40,000 00	40,000 00
	180,000 00	180,000 00

STATISTICAL REPORT ON THE HEALTH OF THE NAVY, &c., FOR THE YEAR 1877.

NORTH ATLANTIC STATION.

The North Atlantic Station has the following geographical limits, viz: Within the latitudes of the banks of Newfoundland and the mouth of the Amazon River, embracing the longitudes of the Western and Madeira Islands.

The following vessels were employed on this station during the year 1877: Powhatan (as flag-ship), Plymouth, Ossipee, Swatara, Essex, Huron, Enterprise, New Hampshire, Canonicus, Manhattan, Wyandotte, Ajax, Catskill, Lehigh, Passaic, Saugus, Mahopac, Dictator, Shawmut, Pawnee, Montauk, and Fortune.

The ensuing tables present the groups of diseases and the cyclical changes in disease movement, as well as the aggregate of classified diseases, during each quarter and for the year.

During the first quarter diseases of the respiratory system were first in the order of frequency, declining until the third quarter, when they rise.

Diseases of the digestive system were next in order in frequency during the first quarter, and rise during the second, only to fall in the fourth quarter. Miasmatic diseases were third in the order of frequency, and fall in the second quarter, to rise in the third and fourth.

The class of wound injuries and accidents during the year is very much increased by reason of the loss of the greater portion of the crew of the Huron on the 24th November, 1877.

The aggregate report on inspection will exhibit the most frequently recurring forms of disease on this station during the year.

The deaths were: from erysipelas, 1; anæmia, 1; typhoid-pneumonia, 1; submersion, 100. This includes the 98 lost on the Huron.

On board the Essex one case of filaria medinensis was reported. It is mentioned on account of the rare occurrence in our service.

The health statistics of each vessel for the year are also appended. The statistics, carefully kept, become of value in determining the health and sick rates of the various kinds and classes of vessels composing our Navy under different climatic conditions.

No epidemic occurred during the year, but the sick-rate has increased over that of 1876.

These statistics, with the more carefully recorded meteorological observations conducted by the bureau, may in the future determine some of the causes of the high sick rate of the maritime community.

Most of the iron-clads were not fully manned for active service, and not therefore engaged as cruisers.

First quarter, 1877. North Atlantic Station.

[Aggregate: Total number of ships' companies, 1,788; total number of sick-days, 2,910; deaths, 2.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	38	35	......	4	......	......
Enthetic	6	20	19	1	4	......	2
Dietic	......	2	2	......	......	......	......
Diathetic	3	28	22	......	8	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	1	......	......	1	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	4	6	9	......	1	......	......
eye	......	7	4	......	......	......	3
ear	......	1	1	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	......	......	......	1	1
respiratory system	3	53	40	......	9	......	7
digestive system	1	43	36	......	4	......	4
urinary and genital system	......	3	2	......	1	......	......
locomotive system	1	2	......	......	2	......	1
integumentary system	2	36	33	......	......	......	5
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	5	58	48	......	5	1	9
Total	26	300	251	1	39	*2	33

* 1 anæmia; 1 drowning.

Second quarter, 1877. North Atlantic Station.

[Aggregate: Total number of ships' companies, 1,709; total number of sick-days, 2,996; deaths, 2.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	34	31	......	1	......	2
Enthetic	2	13	13	......	1	......	1
Dietic	......	......	......	......	......	......	......
Diathetic	1	24	14	......	8	......	3
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	......	16	15	......	1	......	......
eye	3	1	4	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	1	2	2	......	1	......	......
respiratory system	7	41	36	......	5	1	6
digestive system	4	49	42	......	6	......	5
urinary and genital system	......	9	6	......	2	......	1
locomotive system	1	7	4	......	3	......	1
integumentary system	5	37	35	......	1	......	6
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	9	63	63	1	6	1	1
Total	33	297	266	1	35	*2	26

* 1 typhoid-pneumonia; 1 drowning.

Third quarter, 1877. *North Atlantic Station.*

[Aggregate: Total number of ships' companies, 1,700; total number of sick-days, 2,346; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	42	33		4	1	6
Enthetic	1	28	24		3		2
Dietic		7	7				
Diathetic	3	16	8	1	10		
Developmental							
Tubercular		1			1		
Parasitic							
Of the nervous system		11	8		3		
eye		6	3		3		
ear		3	2		1		
teeth							
circulatory system		11	2		9		
respiratory system	6	12	7	2	9		
digestive system	5	55	44	1	12		3
urinary and genital system	1	11	3		9		
locomotive system	1	1	1		1		
integumentary system	6	20	20		6		
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	1	42	31	1	8		3
Total	26	267	194	5	79	*1	14

*1 Erysipelas.

Fourth quarter, 1877. *North Atlantic Station.*

[Aggregate: Total number of ships' companies, 1,860; total number of sick-days, 2,229; deaths, 98.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	6	51	46		7		4
Enthetic	2	49	35		13		3
Dietic		5	5				
Diathetic		15	8		5		2
Developmental							
Tubercular							
Parasitic		1	1				
Of the nervous system		8	5		3		
eye		3	2				1
ear		1	1				
teeth		1	1				
circulatory system		2			2		
respiratory system		16	8		7		1
digestive system	3	25	25		3		
urinary and genital system							
locomotive system							
integumentary system		21	14	1	6		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	3	152	47		8	98	2
Total	14	360	205	1	57	*98	13

*Drowned—Huron.

North Atlantic Station.

AGGREGATE, 1877.

[Average number of ships' companies, 1,764 +; total sick-days, 10,511; deaths, 103; ratio per thousand of cases treated to effectives, 708 +; ratio per thousand of cases treated to effectives, 532 in 1876.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	165	145		16	1	4
Enthetic	6	110	91	1	21		3
Dietic		14	14				
Diathetic	3	83	52	1	31		2
Developmental							
Tubercular		2			2		
Parasitic		2	2				
Of the nervous system	4	41	37		8		
eye		17	13		3		1
ear		5	4		1		
teeth		1	1				
circulatory system		17	4		12	1	
respiratory system	3	122	91	2	30	1	1
digestive system	1	172	147	1	25		
urinary and genital system		33	18		15		
locomotive system	1	10	5		6		
integumentary system	2	114	102	1	13		
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	5	315	189	2	27	100	2
Total	26	1,224	916	8	210	103	13

Powhatan, flag-ship, 2d rate. Wood; paddle; 2,182 *tons.*

[Employed during the year as flag-ship of the North Atlantic Station. Average number of ship's company, 266 +; total sick-days, 2,764; deaths, 1; ratio per thousand of cases treated to effectives, 953 +; ratio per thousand of cases treated to effectives in 1876, 920 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		37	34		3		
Enthetic	2	29	25	1	3		2
Dietic		1	1				
Diathetic	1	14	9		6		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		4	3		1		
eye		6	5				1
ear		2	2				
teeth							
circulatory system		2	1		1		
respiratory system	2	33	28		7		
digestive system		32	29		3		
urinary and genital system		4	2		2		
locomotive system		2	2				
integumentary system	1	19	17		3		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		65	56	1	7	1	
Total	6	250	214	2	36	*1	3

* Drowning.

Plymouth, 2d rate. Wood; screw; 1,122 *tons.*

[Employed during the year on the North Atlantic Station. Average number of ship's company, 231+; total sick-days, 1,489; deaths, 1; ratio per thousand of cases treated to effectives, 854+; ratio per thousand of cases treated to effectives in 1876, 845+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	22	16		4		3
Enthetic		13	6		7		
Dietic		1	1				
Diathetic	1	10	8		3		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		9	9				
eye		1	1				
ear		1			1		
teeth		1	1				
circulatory system		6	5			*1	
respiratory system		34	28		6		
digestive system		24	21		3		
urinary and genital system		3	1		2		
locomotive system		1			1		
integumentary system		32	32				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	44	40		5		
Total	3	202	164		37	1	3

*Anæmia.

Ossipee, 3d rate. Wood; screw; 828 *tons.*

[Employed during the year on the North Atlantic Station. Average number of ship's company, 204+; total sick-days, 781; deaths, 2; ratio per thousand of cases treated to effectives, 444+; ratio per thousand of cases treated to effectives, 1876, 1,015+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		9	6		2	1	
Enthetic	1	7	5		3		
Dietic							
Diathetic		5	3		2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		2			2		
eye		1	1				
ear		1	1				
teeth							
circulatory system		2	1		1		
respiratory system		14	8		5	1	
digestive system	1	8	5		4		
urinary and genital system		5	3		2		
locomotive system		3	2		1		
integumentary system		13	12		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		19	17		2		
Total	2	89	64		25	*2	

*Erysipelas and typhoid-pneumonia.

Swatara, 3d rate. Wood; screw; 910 tons.

[Employed during the year on the North Atlantic Station. Average number of ship's company, 186; total sick-days, 1,493; deaths, 0; ratio per thousand of cases treated to effectives, 865 +; ratio per thousand of cases treated to effectives, 1876, 1,261 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	22	16	......	6	......	......
Enthetic	1	9	8	......	2	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	......	13	8	......	5	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	......	6	5	......	1	......	......
eye	......	1	......	......	1	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	......	......	2	......	......
respiratory system	1	8	5	......	4	......	......
digestive system	......	45	38	1	6	......	......
urinary and genital system	......	3	1	......	2	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	1	16	16	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	1	30	25	1	4	......	1
Total	4	157	124	2	34	......	1

Essex, 3d rate. Wood; screw; 615 tons.

[Employed during the year at Vera Cruz, Norfolk, at sea, and at St. Helena. Average number of ship's company, 180; total sick-days, 769; deaths, 0; ratio per thousand of cases treated to effectives, 472 +; ratio per thousand of cases treated to effectives, 1876, 144 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	26	25	......	......	......	1
Enthetic	1	5	5	......	1	......	......
Dietic	......	2	2	......	......	......	......
Diathetic	......	5	2	......	2	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	1	1	......	......	2	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	12	8	......	3	......	1
digestive system	......	16	15	......	1	......	......
urinary and genital system	......	2	1	......	1	......	......
locomotive system	1	1	......	......	2	......	......
integumentary system	......	4	3	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	7	6	......	1	......	......
Total	3	82	68	......	14	......	3

Huron, 3d rate. Iron; screw; 541 *tons.*

[Employed for 328 days of the year on the North Atlantic Station. Was wrecked November 24, 1877, on the coast of North Carolina. Average ship's company, 128¾. Total sick days, 699—includes all returns received. Deaths, 98.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		9	9				
Enthetic		5	5				
Dietic							
Diathetic		7	7				
Developmental							
Tubercular		2			2		
Parasitic							
Of the nervous system		6	6				
eye							
ear							
teeth							
circulatory system		1	1				
respiratory system		6	5		1		
digestive system		9	8		1		
urinary and genital system		2	2				
locomotive system							
integumentary system		5	5				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	2	110	14			98	
Total	2	162	62		4	*98	

* Drowned.

Enterprise, 3d rate. Screw; 615 *tons.*

[Employed for 290 days in 1877 on the North Atlantic Station. Average number of ship's company, 159. Total sick-days, 345. Deaths, 0. Ratio per thousand of cases treated to effectives, 308+:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		4	4				
Enthetic		5	5				
Dietic		2	2				
Diathetic		5	3		2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		3	2		1		
eye		2	1		1		
ear							
teeth							
circulatory system							
respiratory system		2	1		1		
digestive system		3	2		1		
urinary and genital system		4	2		2		
locomotive system							
integumentary system		5	2	1	2		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		14	11		3		
Total		49	35	1	13		

New Hampshire, 2d rate. Wood; sails; 2,600 tons.

[During the year was stationed at Port Royal, S. C. Average number of ship's company, 114 +; total sick-days, 395; deaths, 0. Ratio per thousand of cases treated to effectives, 332 +; ratio per thousand of cases treated to effectives, 1876, 359 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		3	3				
Enthetic		3	3				
Dietic							
Diathetic		4	2		2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system	1	3	4				
eye		3	3				
ear							
teeth							
circulatory system		2	1		1		
respiratory system							
digestive system		7	6		1		
urinary and genital system		5	5				
locomotive system		1	1				
integumentary system		1	1				
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents		4	3				1
Total	1	37	33		4		1

Canonicus, 4th rate. Iron-clad; screw; 550 tons.

[Employed during the year on the North Atlantic Station at New Orleans, La. Average number of ship's company, 90; total sick-days, 1,018; deaths, 0. Ratio per thousand of cases treated to effectives, 1,155; ratio per thousand of cases treated to effectives, 1876, 930 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		22	18				
Enthetic		13	13				
Dietic		7	7				
Diathetic		10	7	1	2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		7	7				
eye							
ear							
teeth							
circulatory system							
respiratory system		6	4	2			
digestive system		23	21		2		
urinary and genital system							
locomotive system		1			1		
integumentary system		4	3		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	10	9		2		
Total	1	103	93	3	8		

Manhattan, 4th rate. Iron-clad; screw; 550 *tons.*

[Employed during the first, second, and third quarters, 1877, on the North Atlantic Station, at Port Royal Savannah, and Norfolk. Average number of ship's company, 21+ (273 days); total sick-days, 21; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		1	1				
Enthetic		1	1				
Dietic							
Diathetic							
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system							
digestive system							
urinary and genital system		2			2		
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		1	1				
Total		5	3		2		

Wyandotte, 4th rate. Iron-clad; screw; 550 *tons.*

[Employed during the year on the North Atlantic Station. Average number of ship's company, 248+; total sick-days, 65; deaths, 0; ratio per thousand of cases treated to effectives, 408+; ratio per thousand of cases treated to effectives, 1876, 233+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		1	1				
Enthetic		4	2		2		
Dietic							
Diathetic		2	1		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system		1			1		
digestive system							
urinary and genital system							
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		1	1				
Total		10	6		4		

Ajax, 4th rate. Iron-clad; screw; 550 tons.

[Employed during the year on the North Atlantic Station. Average number of ship's company, 44+; total sick-days, 198; deaths, 1; ratio per thousand of cases treated to effectives, 359+; ratio per thousand of cases treated to effectives, 1876, 258.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	2	2	......	......	......	......
Enthetic	......	3	3	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	1	......	......	1	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	1	......	......	1	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	......	......	......	......	......	......
digestive system	......	2	1	......	1	......	......
urinary and genital system	......	1	1	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	4	4	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	2	1	......	......	1	......
Total	......	16	12	......	3	*1	......

*Drowned.

Catskill, 4th rate. Iron-clad; screw; 496 tons.

[Employed during the year on the North Atlantic Station. Average number of ship's company, 22; total sick-days, 112; deaths, 0; ratio per thousand of cases treated to effectives, 455+; ratio per thousand of cases treated to effectives, 1876, 365.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	4	3	......	1	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	1	1	......	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	......	......	1	......	......
respiratory system	......	......	......	......	......	......	......
digestive system	......	1	......	......	1	......	......
urinary and genital system	......	1	......	......	1	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	......	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	......	......	......	......	......	......
Total	1	9	3	......	7	......	......

Lehigh, 4*th rate.* *Iron-clad; screw;* 496 *tons.*

[Employed during the year on the North Atlantic Station. Average number of ship's company, 22 +; total sick-days, 118; deaths, 0; ratio per thousand of cases treated to effectives, 533 +; ratio per thousand of cases treated to effectives in 1876, 169 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	2	2	.....	.....	.....	.....
Enthetic	.....	.....	.....	.....	.....	.....	.....
Dietic	.....	.....	.....	.....	.....	.....	.....
Diathetic	.....	1	.....	.....	1	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	.....	.....	.....	.....	.....	.....
eye	.....	1	.....	.....	1	.....	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	.....	.....	.....	.....	.....	.....
respiratory system	.....	2	1	.....	1	.....	.....
digestive system	.....	.....	.....	.....	.....	.....	.....
urinary and genital system	.....	.....	.....	.....	.....	.....	.....
locomotive system	.....	1	.....	.....	1	.....	.....
integumentary system	.....	2	1	.....	1	.....	.....
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	.....	3	2	.....	1	.....	.....
Total	.....	12	6	.....	6	.....	.....

Passaic, 4*th rate.* *Iron-clad; screw;* 496 *tons.*

[Employed during the year on the North Atlantic Station. Average number of ship's company, 35 +; total sick-days, 103; deaths, 0; ratio per thousand of cases treated to effectives, 307+; ratio per thousand of cases treated to effectives in 1876, 200.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	4	3	.....	1	.....	.....
Enthetic	.....	1	.....	.....	1	.....	.....
Dietic	.....	.....	.....	.....	.....	.....	.....
Diathetic	.....	.....	.....	.....	.....	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	.....	.....	.....	.....	.....	.....
eye	.....	.....	.....	.....	.....	.....	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	.....	.....	.....	.....	.....	.....
respiratory system	.....	1	1	.....	.....	.....	.....
digestive system	.....	.....	.....	.....	.....	.....	.....
urinary and genital system	.....	.....	.....	.....	.....	.....	.....
locomotive system	.....	.....	.....	.....	.....	.....	.....
integumentary system	.....	4	4	.....	.....	.....	.....
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	.....	1	1	.....	.....	.....	.....
Total	.....	11	9	.....	2	.....	.....

Saugus, 4th rate. Iron-clad; screw; 550 tons.

[Employed for 273 days (first, second, and third quarters), 1877, on the North Atlantic Station. Average number of ship's company, 21; total sick-days, 18; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic		1	1				
Dietic							
Diathetic							
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system							
digestive system							
urinary and genital system							
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		1			1		
Total		2	1		1		

Mahopac, 4th rate. Iron-clad; screw; 550 tons.

[Employed for 273 days (first, second, and third quarters), 1877, on the North Atlantic Station. Average number of ship's company, 33 +; total sick-days, 44; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic		2	2				
Dietic							
Diathetic							
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system							
digestive system							
urinary and genital system		1			1		
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents							
Total		3	2		1		

Dictator, 2d rate. Iron-clad; screw; 1,750 tons.

[Employed during the first quarter 1877 on the North Atlantic Station at Port Royal, S. C. Average number of ship's company, 72; total sick-days, 191; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		1	1				
Enthetic		1	1				
Dietic							
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system	2		2				
eye							
ear							
teeth							
circulatory system							
respiratory system		3	2		1		
digestive system							
urinary and genital system							
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		3	2		1		
Total	2	10	10		2		

Shawmut, 3d rate. Wood; screw; 410 tons.

[Employed for 18 days of the first quarter 1877 on the North Atlantic Station. Average number of ship's company, 35; total sick-days, 11.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic	1		1				
Dietic							
Diathetic							
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear		1	1				
teeth							
circulatory system							
respiratory system							
digestive system							
urinary and genital system							
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents							
Total	1	2	3				

Pawnee, 3d rate. Wood; sails; 872 tons.

[Employed for 90 days, first quarter 1877, on the North Atlantic Station, at Port Royal, S. C. Average number of ship's company, 14; total sick-days, 21; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	......	......	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	......	......	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	2	1	......	1	......	......
digestive system	......	......	......	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	......	......	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	......	......	......	......	......	......
Total	......	2	1	......	1	......	......

Montauk, 4th rate. Iron-clad; screw; 496 tons.

[Employed for 181 days, first and second quarters 1877, on the North Atlantic Station. Average number ship's company, 27+; total sick-days, 16; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	......	......	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	3	1	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	......	......	......	......	......	......
digestive system	......	......	......	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	......	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries and accidents	......	......	......	......	......	......	......
Total	......	4	1	......	3	......	......

Fortune, 4th rate. Screw; 306 tons.

[Employed during the fourth quarter 1877 on the North Atlantic squadron. Average number of ship's company, 51; total sick-days, 32; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	4	2	......	1	......	1
Dietic	......	......	......	......	......	......	......
Diathetic	......	1	......	......	......	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	......	......	1	......	......
respiratory system	......	......	......	......	......	......	......
digestive system	......	......	......	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	......	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	......	......	......	......	......	......
Total	......	7	2	......	3	......	2

SOUTH ATLANTIC STATION.

The geographic limits of this station are the southeast coast of South America and part of the west coast of Africa.

During the year 1877, the following vessels were employed at different times upon this station, viz: Hartford (as flag-ship), Richmond, Adams, and Frolic.

The Hartford arrived on the station during the fourth quarter; previous to this time (during the first, second, and third quarters) the service of this vessel was on the North Atlantic.

The Richmond was *en route* home from the South Pacific Station and was employed on this station until going out of commission—a period of 260 days.

The deaths were, one from pernicious fever, one from organic disease of the heart, and one from drowning.

No epidemic occurred on this station.

The usual tables are appended.

First quarter, 1877. South Atlantic Station.

[Aggregate: Total number of ships' companies, 1,074; total number of sick-days, 2,150; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	9	9				1
Enthetic	4	18	14		3		5
Dietic		4	4				
Diathetic	1	12	8		3		2
Developmental							
Tubercular							
Parasitic							
Of the nervous system	2	5	4		1		2
eye		4	3				1
ear							
teeth							
circulatory system		5	2		1		2
respiratory system	2	15	13		2		2
digestive system	2	17	16		2		1
urinary and genital system	1	6	7				
locomotive system							
integumentary system	4	26	27				3
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	4	46	44				6
Total	21	167	151		12		25

Second quarter, 1877. South Atlantic Station.

[Aggregate: Total number of ships' companies, 997; total number of sick-days, 2,073; deaths, 2.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	17	14		1		3
Enthetic	5	16	16		4		1
Dietic		3	3				
Diathetic	2	12	9		2		3
Developmental							
Tubercular							
Parasitic							
Of the nervous system	2	7	7				2
eye	1	2	3				
ear							
teeth							
circulatory system	2	4	1		3	*1	1
respiratory system	2	12	8		5		1
digestive system	1	22	20				3
urinary and genital system		5	5				
locomotive system		1					1
integumentary system	3	24	23		2		2
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	6	39	40			†1	4
Total	25	164	149		17	2	21

*Organic disease of heart. †Drowned.

Third quarter, 1877. South Atlantic Station.

[Aggregate: Total number of ships' companies, 972; total number of sick-days, 1,578; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	17	18	......	1	*1	......
Enthetic	1	3	3	......	1	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	3	11	7	......	7	......	......
Developmental	......	1	......	......	1	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	2	8	5	......	4	......	1
eye	......	4	3	......	1	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	1	1	......	......	2	......	......
respiratory system	1	13	8	......	4	......	2
digestive system	3	28	27	......	3	......	1
urinary and genital system	......	3	3	......	......	......	......
locomotive system	1	1	2	......	......	......	......
integumentary system	2	22	17	1	2	......	4
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	4	37	31	......	6	......	4
Total	21	151	126	1	32	1	12

* Pernicious fever.

Fourth quarter, 1877. South Atlantic Station.

[Aggregate: Total number of ships' companies, 714; total sick-days, 1,494; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	21	15	......	3	......	3
Enthetic	......	15	11	......	1	......	3
Dietic	......	3	2	......	......	......	1
Diathetic	......	10	8	......	......	......	2
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	1	7	8	......	......	......	......
eye	......	4	3	......	......	......	1
ear	......	2	1	......	1	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	2	14	11	......	2	......	3
digestive system	1	20	19	......	2	......	......
urinary and genital system	......	8	6	......	1	......	1
locomotive system	......	2	......	......	2	......	......
integumentary system	4	14	15	......	1	......	2
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	4	31	31	......	1	......	3
Total	12	152	131	......	14	......	19

South Atlantic Station.

AGGREGATE, 1877.

[Average number ships' companies, 939 +; total sick-days, 7,295; ratio per thousand of cases treated to effectives, 697 +; in 1876, = 727 +; deaths, 3.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	64	56	......	5	1	3
Enthetic	4	52	44	......	9	......	3
Dietic	......	11	10	......	......	......	1
Diathetic	1	45	32	......	12	......	2
Developmental	......	1	......	......	1	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	2	2	......	......	......	......
Of the nervous system	2	27	24	......	5	......	......
eye	......	14	12	......	1	......	1
ear	......	2	1	......	1	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	10	3	......	6	1	......
respiratory system	2	54	40	......	13	......	3
digestive system	2	87	82	......	7	......	......
urinary and genital system	1	22	21	......	1	......	1
locomotive system	......	4	2	......	2	......	......
integumentary system	4	86	82	1	5	......	2
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	4	153	146	......	7	1	3
Total	21	634	557	1	75	3	19

Hartford, flag-ship, 2d rate. Wood; screw; 2,000 tons.

[Employed during the first, second, and third quarters on North Atlantic Station; during the fourth quarter was at sea as flag-ship of South Atlantic Station. Average number of ship's company, 3,974; total sick-days, 2,443; deaths, 0; ratio per thousand of cases treated to effectives, 790+; ratio per thousand of cases treated to effectives in 1876, 933.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	38	30	......	5	......	3
Enthetic	1	24	15	......	9	......	1
Dietic	......	4	4	......	......	......	......
Diathetic	......	26	15	......	10	......	2
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	1	12	10	......	3	......	......
eye	......	9	7	......	1	......	1
ear	......	2	1	......	1	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	6	2	......	4	......	......
respiratory system	1	26	15	......	10	......	2
digestive system	1	47	43	......	5	......	......
urinary and genital system	......	10	10	......	......	......	......
locomotive system	......	2	......	......	2	......	......
integumentary system	1	31	28	......	3	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	71	65	......	3	......	3
Total	5	309	245	......	56	......	13

Richmond, 2d rate. Wood; screw; 2,000 tons.

[Employed for 260 days of 1877 on the South Atlantic Station and *en route* home. Average number of ship's company, 303+; total sick-days, 2,724; deaths, 2; ratio per thousand of cases treated to effectives (260 days), 530; ratio per thousand of cases treated to effectives in 1876, 622+].

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	20	20			1	
Enthetic	3	16	19				
Dietic		2	2				
Diathetic		7	6		1		
Developmental		1			1		
Tubercular							
Parasitic		1	1				
Of the nervous system	1	4	3		2		
eye		4	4				
ear							
teeth							
circulatory system		3			2	1	
respiratory system	1	10	10		1		
digestive system	1	14	15				
urinary and genital system		1	1				
locomotive system		2	2				
integumentary system	2	23	23	1	1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	3	41	41		3		
Total	12	149	147	1	11	2	

Adams, 3d rate. Screw; wood; 615 tons.

[During the first quarter was on the North Atlantic, and the rest of the year on the South Atlantic Station. Average number of ship's company, 216+; total sick-days, 1,432; deaths, 0; ratio per thousand of cases treated to effectives, 526+; in 1876, 175+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		3	3				
Enthetic		11	9				2
Dietic		4	3				1
Diathetic		11	11				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		7	7				
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system		13	11		1		1
digestive system		14	13		1		
urinary and genital system		8	7				1
locomotive system							
integumentary system	1	22	22				1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	18	19				
Total	2	112	106		2		6

Frolic, 4th rate. Iron: paddle-wheel; 614 tons.

[Employed for 304 days of 1877 on the South Atlantic Station. Average number of ship's company 97 +; total sick-days, 696; deaths, 1; ratio per thousand of cases treated to effectives (304 days), 689 +; ratio per thousand of cases treated to effectives in 1876, 453.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	3	3	.....	.....	.....	.....
Enthetic	.....	1	1	.....	.....	.....	.....
Dietic	.....	1	1	.....	.....	.....	.....
Diathetic	1	1	1	.....	1	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	4	4	.....	.....	.....	.....
eye	.....	.....	.....	.....	.....	.....	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	2	2	.....	.....	.....	.....
respiratory system	.....	4	3	.....	1	.....	.....
digestive system	.....	12	11	.....	1	.....	.....
urinary and genital system	1	3	3	.....	1	.....	.....
locomotive system	.....	.....	.....	.....	.....	.....	.....
integumentary system	.....	10	9	.....	.....	.....	.....
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	.....	23	21	.....	1	1	.....
Total	2	64	59	.....	6	1	.....

EUROPEAN STATION.

The geographic limits of this station are all the coasts of Europe, the Mediterranean, and part of the west coast of Africa.

The following vessels were employed on this station: Trenton (flagship), Vandalia, Marion, Alliance, and Dispatch.

The usual tables are appended.

The deaths were, one from drowning, one from asthma, one from valvular disease of the heart, and one from typhoid-pneumonia.

During the first quarter, on the Trenton, then in New York, there appeared an epidemic of cynanche parotidæ, numbering 15 cases. The Minnesota at the same time, in close proximity, reports 10 cases.

First quarter, 1877. European Station.

[Aggregate: Total number of ships' companies, 1,103; total number of sick-days, 1,692; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	36	34	......	......	......	2
Enthetic	3	12	12	......	......	......	3
Dietic	......	5	5	......	......	......	......
Diathetic	......	15	12	......	1	......	2
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	1	14	14	......	......	......	1
eye	......	5	4	......	......	......	1
ear	......	2	1	......	1	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	1	......	1	......	......
respiratory system	......	47	43	......	1	......	3
digestive system	......	32	31	......	1	......	......
urinary and genital system	......	8	5	......	1	......	2
locomotive system	......	......	......	......	......	......	......
integumentary system	2	19	19	......	......	......	2
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	2	50	38	......	1	1	12
Total	8	247	219	......	7	1*	28

* Drowned.

Second quarter, 1877. European Station.

[Aggregate: Total number of ships' companies, 1,090; total number of sick-days, 2,437; deaths, 2.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	36	36	1	1	......	......
Enthetic	3	18	18	......	......	......	3
Dietic	......	4	4	......	......	......	......
Diathetic	2	22	22	......	1	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	1	19	16	......	......	......	4
eye	1	6	7	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	5	1	......	1	1*	2
respiratory system	3	24	23	......	3	1†	......
digestive system	......	44	42	......	......	......	2
urinary and genital system	2	8	7	......	......	......	3
locomotive system	......	......	......	......	......	......	......
integumentary system	2	34	35	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	12	58	63	......	1	......	6
Total	28	278	274	1	8	2	21

*Asthma. † Morb. valvul. cord.

Third quarter, 1877. European Station.

[Aggregate: Total number of ships' companies, 1,088; total number of sick-days, 2,845; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	35	35	.....	.....	.....	.....
Enthetic	3	17	17	.....	.....	.....	3
Dietic	.....	3	3	.....	.....	.....	.....
Diathetic	1	15	15	.....	.....	.....	1
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	2	2	.....	.....	.....	.....
Of the nervous system	4	25	23	.....	1	.....	5
eye	.....	6	6	.....	.....	.....	.....
ear	.....	1	1	.....	.....	.....	.....
teeth	.....	1	1	.....	.....	.....	.....
circulatory system	2	2	1	.....	2	.....	1
respiratory system	.....	25	19	.....	1	.....	5
digestive system	2	62	61	.....	.....	.....	3
urinary and genital system	3	8	9	.....	.....	.....	2
locomotive system	.....	2	2	.....	.....	.....	.....
integumentary system	.....	48	48	.....	.....	.....	.....
Non-malignant tumors and cysts	.....	2	2	.....	.....	.....	.....
Wounds, injuries, and accidents	6	57	60	.....	.....	.....	3
Total	21	311	305	.....	4	.....	23

Fourth quarter, 1877. European Station.

[Aggregate: Total number of ships' companies, 1,076; total number of sick-days, 2,121; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	20	20	.....	.....	.....	.....
Enthetic	3	21	16	.....	2	.....	6
Dietic	.....	6	5	.....	.....	.....	1
Diathetic	1	14	13	.....	2	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	5	18	19	.....	3	.....	1
eye	.....	2	1	.....	1	.....	.....
ear	.....	1	1	.....	.....	.....	.....
teeth	.....	1	1	.....	.....	.....	.....
circulatory system	1	1	.....	.....	2	.....	.....
respiratory system	5	26	22	.....	5	*1	3
digestive system	3	32	34	.....	.....	.....	1
urinary and genital system	2	6	7	.....	.....	.....	1
locomotive system	.....	.....	.....	.....	.....	.....	.....
integumentary system	.....	43	39	.....	1	.....	3
Non-malignant tumors and cysts	.....	1	1	.....	.....	.....	.....
Wounds, injuries, and accidents	3	47	47	.....	.....	.....	3
Total	23	239	226	.....	16	1	19

* Typhoid-pneumonia.

European Station.

AGGREGATE, 1877.

[Average number ships' companies, 1,089 +; total sick-days, 9,165. Ratio per thousand of cases treated to effectives, 984 +; 746 + in 1876; deaths, 4.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		127	125	1	1		
Enthetic	3	68	63		2		6
Dietic		18	17				1
Diathetic		66	62		4		
Developmental							
Tubercular							
Parasitic		2	2				
Of the nervous system	1	76	72		4		1
eye		19	18		1		
ear		4	3		1		
teeth		2	2				
circulatory system		10	3		6	1	
respiratory system		122	107		10	2	3
digestive system		170	168		1		1
urinary and genital system		30	28		1		1
locomotive system		2	2				
integumentary system	2	144	141		2		3
Non-malignant tumors and cysts		3	3				
Wounds, injuries, and accidents	2	212	208		2	1	3
Total	8	1,075	1,024	1	35	4	19

Trenton, flag-ship, 2d rate. Wood; screw; 2,300 tons.

[Employed for 310 days in 1877 on European Station. Average number of ship's company, 465 +; total sick-days, 3,468; deaths, 3. Ratio per thousand of cases treated to effectives, 717 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		41	40	1			
Enthetic		24	19		2		3
Dietic		3	3				
Diathetic		34	32		2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		12	11		1		
eye		8	7		1		
ear		1			1		
teeth							
circulatory system		7	1		5	1	
respiratory system		26	20		5	1	
digestive system		33	33				
urinary and genital system		10	8		1		1
locomotive system							
integumentary system		56	55				1
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents		88	84		1	1	2
Total		344	314	1	19	3	7

Despatch, 4th rate. Wood; screw; 730 tons.

[Employed during the year on the European Station. Average number of ship's company, 51 +; total sick-days, 482; deaths, 0. Ratio per thousand of cases treated to effectives, 921 +; ratio per thousand of cases treated to effectives in 1876, 695 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	10	9	......	1	......	......
Enthetic	......	9	9	......	......	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	......	1	1	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	1	1	......	......	......	......
ear	......	1	1	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	4	4	......	......	......	......
digestive system	......	14	14	......	......	......	......
urinary and genital system	......	1	1	......	......	......	......
locomotive system	......	1	1	......	......	......	......
integumentary system	......	2	2	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	6	6	......	......	......	......
Total	......	51	50	......	1	......	......

Vandalia, 3d rate. Screw; 981 tons.

[Employed during the year on the European Station. Average number of ship's company, 192 +; total sick-days, 1,516; deaths, 1. Ratio per thousand of cases treated to effectives, 907 +; ratio per thousand of cases treated to effectives in 1876, 728 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	36	36	......	......	......	......
Enthetic	1	8	9	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	4	3	......	1	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	2	2	......	......	......	......
Of the nervous system	1	16	16	......	1	......	......
eye	......	4	4	......	......	......	......
ear	......	1	1	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	19	17	......	......	1	1
digestive system	......	15	15	......	......	......	......
urinary and genital system	......	9	9	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	28	25	......	2	......	1
Non-malignant tumors and cysts	......	1	1	......	......	......	......
Wounds, injuries, and accidents	......	30	30	......	......	......	......
Total	2	173	168	......	4	1	2

Marion, 3d rate. Wood; screw; 910 tons.

[Employed during the year on the European Station. Average number of ship's company, 217 +; total sick-days, 2,129; deaths, 0. Ratio per thousand of cases treated to effectives, 1,204 +. Ratio per thousand of cases treated to effectives in 1876, 1,332 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		15	15				
Enthetic	2	17	17				2
Dietic		13	12				1
Diathetic		9	9				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		9	9				
eye		5	5				
ear		1	1				
teeth		2	2				
circulatory system							
respiratory system		52	48		2		2
digestive system		47	47				
urinary and genital system		6	6				
locomotive system							
integumentary system	2	38	39				1
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	2	41	42				1
Total	6	256	253		2		7

Alliance, 3d rate. Screw; 615 tons.

[Employed during the year on the European Station. Average number of ship's company, 159 +; total sick-days, 1,510; deaths, 0. Ratio per thousand of cases treated to effectives, 1,576 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		25	25				
Enthetic		10	9				1
Dietic		1	1				
Diathetic		18	17		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		39	36		2		1
eye		1	1				
ear							
teeth							
circulatory system		3	2		1		
respiratory system		21	18		3		
digestive system		61	59		1		1
urinary and genital system		4	4				
locomotive system		1	1				
integumentary system		20	20				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		47	46		1		
Total		251	239		9		3

NORTH PACIFIC STATION.

The geographic limits of this station are north of the equator, except so much of the west coast of South America and of the Isthmus as lies between the equator and Panama and the Sandwich Istands.

The following vessels were employed on this station: Pensacola (flagship) and Lackawanna.

The usual tables are appended and explain themselves.

The deaths were one from angina pectoris, one from pneumonia, and one from fracture of the cranium.

First quarter, 1877. North Pacific Station.

[Aggregate: Total number of ships' companies, 591; total number of sick-days, 1,354; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	16	18	......	......	......	1
Enthetic	2	12	11	......	......	......	3
Dietic	1	2	3	......	......	......	......
Diathetic	2	6	5	......	2	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	10	8	1	1	......	......
eye	......	1	1	......	......	......	......
ear	......	1	......	1	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	......	......	......	......	1
respiratory system	3	12	7	2	3	......	3
digestive system	......	12	11	......	......	......	1
urinary and genital system	......	3	2	......	......	......	1
locomotive system	......	1	1	......	......	......	......
integumentary system	......	14	12	......	......	......	2
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	2	39	35	......	1	......	18
Total	13	130	114	4	7	......	18

Second quarter, 1877. North Pacific Station.

[Aggregate: Total number of ships' companies, 595; total number of sick-days, 1,392; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	13	11	......	......	......	3
Enthetic	3	4	6	......	......	......	1
Dietic	......	......	......	......	......	......	......
Diathetic	1	11	11	......	......	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	11	10	......	......	......	1
eye	......	4	4	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	1	......	1	......	......	......	......
respiratory system	3	4	5	......	......	......	2
digestive system	1	9	10	......	......	......	......
urinary and genital system	1	7	7	......	......	......	1
locomotive system	......	......	......	......	......	......	......
integumentary system	2	26	23	......	......	......	5
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	5	26	26	......	......	*1	4
Total	18	115	114	......	......	1	18

* Fracture of skull.

Third quarter, 1877. North Pacific Station.

[Aggregate: Total number of ships' companies, 557; total number of sick-days, 978; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	7	8		1		1
Enthetic	1	2	1		1		1
Dietic		15	15				
Diathetic	1	10	9		1		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system	1	2	2		1		
eye							
ear							
teeth							
circulatory system		1			1		
respiratory system	2	10	8		3		1
digestive system		26	25		1		
urinary and genital system	1	5	6				
locomotive system							
integumentary system	5	16	18	1	1		1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	4	32	32		2		2
Total	18	126	124	1	12		7

Fourth quarter, 1877. North Pacific Station.

[Aggregate: Total number of ships' companies, 500; total number of sick-days, 864; deaths, 2.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	1	1				1
Enthetic	1	4	5				
Dietic		3	3				
Diathetic	1	8	7		2		
Developmental		2			1		1
Tubercular							
Parasitic							
Of the nervous system		6	5				1
eye		2	1				1
ear		1	1				
teeth		1	1				
circulatory system		2			1	*1	
respiratory system	1	8	7		1	†1	
digestive system		13	13				
urinary and genital system		7	5		1		1
locomotive system							
integumentary system	1	8	8		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	2	30	26	1	2		3
Total	7	96	83	1	9	2	8

* Angina pectoris. † Pneumonia typhoides.

North Pacific Station.

AGGREGATE, 1877.

[Average number of ships' companies, 560 +; total sick-days, 4,568. Ratio per thousand of cases treated to effectives, 839 +. Deaths, 3.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	37	38	......	1	......	1
Enthetic	2	22	23	......	1	......	......
Dietic	1	20	21	......	......	......	......
Diathetic	2	35	32	......	5	......	......
Developmental	......	2	......	......	1	......	1
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	29	25	1	2	......	1
eye	......	7	6	......	......	......	1
ear	......	2	1	1	......	......	......
teeth	......	1	1	......	......	......	......
circulatory system	......	4	1	......	2	1	......
respiratory system	3	34	27	2	7	1	......
digestive system	......	60	59	......	1	......	......
urinary and genital system	......	22	20	......	1	......	1
locomotive system	......	1	1	......	......	......	......
integumentary system	......	64	61	1	2	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	2	127	119	1	5	1	3
Total	13	467	435	6	28	3	8

Pensacola, flag-ship, 2d rate. Wood; screw; 2,000 tons.

[For the year 1877 was employed on the North Pacific Station. Average number of ship's company 370 +; total sick-days, 3,480; deaths, 1. Ratio per thousand of cases treated to effectives, 998 +. Ratio per thousand of cases treated to effectives in 1876, 1,464 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	34	34	......	1	......	1
Enthetic	......	15	14	......	1	......	......
Dietic	......	18	18	......	......	......	......
Diathetic	2	28	27	......	3	......	......
Developmental	......	2	......	......	1	......	1
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	23	20	......	2	......	1
eye	......	5	4	......	......	......	1
ear	......	1	1	......	......	......	......
teeth	......	1	1	......	......	......	......
circulatory system	......	1	......	......	1	......	......
respiratory system	1	18	15	......	3	*1	......
digestive system	......	53	52	......	1	......	......
urinary and genital system	......	15	13	......	1	......	1
locomotive system	......	......	......	......	......	......	......
integumentary system	......	54	52	1	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	96	89	1	3	......	3
Total	5	364	340	2	18	1	8

*Pneumonia.

Lackawanna, 2d rate. Wood; screw; 1,026 tons.

[Employed during the year on the North Pacific Station. Average number of ship's company, 187+; total sick-days, 1,108; deaths, 2. Ratio per thousand of cases treated to effectives, 592+. Ratio per thousand of cases treated to effectives in 1876, 490+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	3	4	......	......	......	......
Enthetic	2	7	9	......	......	......	......
Dietic	1	2	3	......	......	......	......
Diathetic	......	7	5	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	6	5	1	......	......	......
eye	......	2	2	......	......	......	......
ear	......	1	......	1	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	3	1	......	1	*1	......
respiratory system	2	16	12	2	4	......	......
digestive system	......	7	7	......	......	......	......
urinary and genital system	......	7	7	......	......	......	......
locomotive system	......	1	1	......	......	......	......
integumentary system	......	10	9	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	2	31	30	......	2	†1	......
Total	8	103	95	4	10	2	......

* Angina pectoris. † Fracture of skull.

SOUTH PACIFIC STATION.

The geographic limits of this station are the west coast of the Isthmus and South America, lying between Panama and the equator, the west coast of South America, the islands and waters of the Pacific south of the equator as far west as the one hundred and fiftieth parallel, including the coast and sea-ports of Australia.

The vessels employed on this station were the Omaha (flag ship) and Onward.

The usual tables are appended.

The Omaha, being the cruising-vessel, presents more of the climatic effects upon her crew.

The Onward was stationed at Callao, Peru.

The ratio of cases treated, per thousand, to effectives on this station for the year is very large, *i. e.*, 1,948.

The same ratio applied to both the North and South Pacific squadrons combined is 1,300 against 1,046 in 1876.

First quarter, 1877. *South Pacific Squadron.*

[Aggregate: Total number of ships' companies, 287; total number of sick-days, 1,045; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	33	31				4
Enthetic	4	10	9				5
Dietic		5	5				
Diathetic		14	13		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		3		1	2		
eye		1					1
ear							
teeth							
circulatory system		3		1	2		
respiratory system	1	3	2		1		1
digestive system	2	18	18				2
urinary and genital system	1	4	4		1		
locomotive system		1			1		
integumentary system		9	9				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		17	16				1
Total	10	121	107	2	8		14

Second quarter, 1877. *South Pacific Station.*

[Aggregate: Total number of ships' companies, 298; total number of sick-days, 1,469; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	4	49	53				
Enthetic	5	10	13		1		1
Dietic		11	11				
Diathetic		17	16		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		6	4	1			1
eye	1	1	1	1			
ear		2	2				
teeth							
circulatory system		1					1
respiratory system	1	3	3				1
digestive system	2	24	23		1		2
urinary and genital system		2	1				1
locomotive system							
integumentary system		29	27				2
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	30	27				4
Total	14	185	181	2	3		13

Third quarter, 1877. South Pacific Station.

[Aggregate: Total number of ships' companies, 301; total number of sick-days, 1,161; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		30	29		1		
Enthetic	1	12	12				1
Dietic		15	14	1			
Diathetic		3	3				
Developmental							
Tubercular							
Parasitic							
Of the nervous system	1	1	1		1		
eye							
ear		1	1				
teeth							
circulatory system	1	1	1		1		
respiratory system	1	7	6		1		1
digestive system	2	6	7		1		
urinary and genital system	1	8	7		2		
locomotive system							
integumentary system	2	9	10		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	4	20	20		1		3
Total	13	113	111	1	9		5

Fourth quarter, 1877. South Pacific Station.

[Aggregate: Total number of ships' companies, 296+; total number of sick-days, 936; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		12	11				1
Enthetic	1	10	10				1
Dietic		3	3				
Diathetic		10	9				1
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear		1					1
teeth							
circulatory system	1	9	10				
respiratory system		16	15				1
digestive system		16	16				
urinary and genital system							
locomotive system							
integumentary system		8	7				1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	3	26	25				4
Total	5	111	106				10

South Pacific Station.

AGGREGATE, 1877.

[Average number of ships' companies, 270+; total sick-days, 4,611; ratio per thousand of cases treated to effectives, 1,948+; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	124	124	......	1	......	1
Enthetic	4	42	44	......	1	......	1
Dietic	......	34	33	1	......	......	......
Diathetic	......	44	41	......	2	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	10	5	2	3	......	......
eye	......	2	1	1	......	......	......
ear	......	4	3	......	......	......	1
teeth	......	......	......	......	......	......	......
circulatory system	......	5	1	1	3	......	......
respiratory system	1	22	21	......	2	......	......
digestive system	2	64	64	......	2	......	......
urinary and genital system	1	17	16	......	2	......	......
locomotive system	......	1	......	......	1	......	......
integumentary system	......	55	53	......	1	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	93	88	......	1	......	4
Total	10	517	494	5	19	......	9

Omaha, flag-ship, 2d rate. Wood; screw; 1,122 *tons.*

[Employed in 1877 on the South Pacific Station. Average number of ship's company, 249+; total sick-days, 4,133; deaths, 0; ratio per thousand of cases treated to effectives, 1,923+; ratio per thousand of cases treated to effectives in 1876, 1,699+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	108	108	......	1	......	1
Enthetic	4	40	42	......	1	......	1
Dietic	......	34	33	1	......	......	......
Diathetic	......	42	39	......	2	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	6	5	......	1	......	......
eye	......	1	......	1	......	......	......
ear	......	3	2	......	......	......	1
teeth	......	......	......	......	......	......	......
circulatory system	......	3	......	......	3	......	......
respiratory system	......	20	18	......	2	......	......
digestive system	1	60	58	......	2	......	1
urinary and genital system	1	15	14	......	2	......	......
locomotive system	......	1	......	......	1	......	......
integumentary system	......	49	47	......	1	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	90	85	......	1	......	4
Total	8	472	451	2	17	......	10

Onward, 4th rate. Sails; wood; 804 *tons.*

[Employed during 1877 on South Pacific Station at Callao. Average number of ship's company, 46 total sick-days, 478; deaths, 0; ratio per thousand of cases treated to effectives, 1,021 +; ratio per thousand of cases treated to effectives in 1876, 846 +].

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	16	16	......	......	......	......
Enthetic	......	2	2	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	2	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	4	......	2	2	......	......
eye	......	1	1	......	......	......	......
ear	......	1	1	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	1	1	......	......	......
respiratory system	1	2	3	......	......	......	......
digestive system	1	4	5	......	......	......	......
urinary and genital system	......	2	2	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	6	6	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	3	3	......	......	......	......
Total	2	45	42	3	2	......	......

ASIATIC STATION.

The geographic limits of this station are the eastern coast of Asia and the adjacent islands.

The following vessels were employed on this station: Tennessee (flag-ship), Monongahela, Kearsarge, Monocacy, Ashuelot, Alert, Ranger, Yantic, and Palos.

The usual tables are appended.

The deaths were two from epidemic cholera, one from acute dysentery, one from remittent fever, one from croupous pneumonia, one from cancer of the rectum, one from compound fracture from a fall from aloft, one from a pistol-shot wound of the cranium, and one from drowning.

During the latter part of the third and commencement of the fourth quarter, a slight epidemic of cholera appeared on the Ranger; 5 cases and 2 deaths are reported. No history of the origin, &c., has been presented.

First quarter, 1877. *Asiatic Station.*

[Aggregate: Total number of ships' companies, 1,456; total number of sick-days, 4,344; deaths, 3.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	32	27		3		3
Enthetic	9	31	32		1		7
Dietic		3	3				
Diathetic	7	50	43		7		7
Developmental							
Tubercular							
Parasitic		3	3				
Of the nervous system	1	23	21		2		1
eye		8	7				1
ear		3	3				
teeth		1	1				
circulatory system		5	3				2
respiratory system	1	41	28		4	*1	9
digestive system	6	75	69		1	†1	10
urinary and genital system	2	16	10		3		5
locomotive system							
integumentary system	7	47	51				3
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	8	72	65		2	‡1	12
Total	42	411	367		23	3	60

*Croupous pneumonia. †Cancer of rectum. ‡Compound fracture of cranium. Fell from aloft

Second quarter, 1877. *Asiatic Station.*

[Aggregate: Total number of ships' companies, 1,479; total number of sick-days, 4,467; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	46	44	1	1		3
Enthetic	7	46	31	1	10		11
Dietic		7	7				
Diathetic	7	42	39		9		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system	1	10	7		2		2
eye	1	15	14	1	1		
ear							
teeth		1	1				
circulatory system	2	2	2		2		
respiratory system	9	39	38		6		4
digestive system	10	51	50		5		6
urinary and genital system	5	14	15		2		2
locomotive system		4	2		1		1
integumentary system	3	42	39		1		5
Non-malignant tumors and cysts		3	2				1
Wounds, injuries, and accidents	12	94	97		2	1	6
Total	60	416	388	3	42	*1	42

*Pistol-shot wound of head.

Third quarter, 1877. Asiatic Station.

[Aggregate: Total number of ships' companies, 1,425; total number of sick-days, 4,067; deaths, 3.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	39	38	.....	1	2	1
Enthetic	11	43	39	.....	10	.....	5
Dietic	.....	13	13	.....	.....	.....	.....
Diathetic	1	41	24	.....	9	.....	9
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	2	24	22	.....	2	.....	2
eye	.....	3	2	.....	.....	.....	1
ear	.....	9	7	.....	1	.....	1
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	5	2	.....	3	.....	.....
respiratory system	4	32	29	.....	5	1	
digestive system	6	102	99	1	3	.....	
urinary and genital system	2	15	13	.....	3	.....	
locomotive system	1	·1	2	.....	.....	.....	.....
integumentary system	5	47	44	.....	2	.....	6
Non-malignant tumors and cysts	1	3	3	.....	.....	.....	1
Wounds, injuries, and accidents	6	84	80	.....	3	.....	7
Total	42	461	417	1	42	*3	40

* One cholera epidemica; one febris remittens; one drowning.

Fourth quarter, 1877. Asiatic Station.

[Aggregate: Total number of ships' companies, 1,429; total number of sick-days, 4,705; deaths, 2.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	59	49	.....	5	1	5
Enthetic	5	38	34	.....	7	.....	2
Dietic	.....	8	8	.....	.....	.....	.....
Diathetic	9	28	30	.....	5	.....	2
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	1	1	.....	.....	.....	.....
Of the nervous system	2	13	10	.....	5	.....	.....
eye	1	6	7	.....	.....	.....	.....
ear	1	4	3	.....	.....	.....	2
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	5	2	.....	3	.....	.....
respiratory system	1	47	32	.....	7	.....	9
digestive system	5	88	84	.....	2	1	6
urinary and genital system	1	13	12	.....	1	.....	1
locomotive system	.....	3	3	.....	.....	.....	.....
integumentary system	6	57	53	.....	1	.....	9
Non-malignant tumors and cysts	1	.....	1	.....	.....	.....	.....
Wounds, injuries, and accidents	7	81	77	.....	5	.....	6
Total	40	451	406	.....	41	*2	42

* One cholera epidemica; one acute dysentery.

Asiatic Station.

AGGREGATE, 1877.

[Average number of ships' companies, 1,447+; total sick-days, 17,581; deaths, 9; ratio per thousand of cases treated to effectives, 1,230+, 1,254+ in 1876.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	176	158	1	10	3	5
Enthetic	9	158	136	1	28	......	2
Dietic	......	31	31	......	......	......	......
Diathetic	7	161	136	......	30	......	2
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	4	4	......	......	......	......
Of the nervous system	1	70	60	......	11	......	......
eye	......	32	30	1	1	......	......
ear	......	16	13	......	1	......	2
teeth	......	2	2	......	......	......	......
circulatory system	......	17	9	......	8	......	......
respiratory system	1	159	127	......	22	2	9
digestive system	6	316	302	1	11	2	6
urinary and genital system	2	58	50	......	9	......	1
locomotive system	......	8	7	......	1	......	......
integumentary system	7	193	187	......	4	......	9
Non-malignant tumors and cysts	......	7	7	......	......	......	......
Wounds, injuries, and accidents	8	331	319	......	12	2	6
Total	42	1,739	1,578	4	148	9	42

Tennessee, flag-ship, 2d rate. Wood; screw; 2,840 tons.

[Employed during the year on the Asiatic Station. Average number of ship's company, 427+; total sick-days, 6,338; deaths, 0; ratio per thousand of cases treated to effectives, 1,511+; ratio per thousand of cases treated to effectives, 1876, 2,042.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	52	48	......	2	......	3
Enthetic	3	57	44	......	15	......	1
Dietic	......	9	9	......	......	......	......
Diathetic	5	75	68	......	11	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	2	2	......	......	......	......
Of the nervous system	......	29	28	......	1	......	......
eye	......	13	13	......	......	......	......
ear	......	10	8	......	......	......	2
teeth	......	2	2	......	......	......	......
circulatory system	......	11	7	......	4	......	......
respiratory system	......	46	38	......	6	......	2
digestive system	1	101	97	......	1	......	4
urinary and genital system	......	16	14	......	1	......	1
locomotive system	......	1	1	......	......	......	......
integumentary system	3	86	83	......	2	......	4
Non-malignant tumors and cysts	......	2	2	......	......	......	......
Wounds, injuries, and accidents	5	116	120	......	1	......	......
Total	18	628	584	......	44	......	18

Monongahela, 2d rate. Wood; screw; 960 tons.

[During the first and second quarters was employed on the Northern Atlantic Station, the third quarter was *en route* to and on the Asiatic during the fourth quarter, 1877. Average number of ship's company 245 +; total sick-days, 2,555; deaths, 0; ratio per thousand of cases treated to effectives, 1,094 +; ratio per thousand of cases treated to effectives, 1876, 1,130 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		30	30				
Enthetic	1	19	16		3		1
Dietic		2	2				
Diathetic		28	22		5		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system		6	6				
eye		3	2		1		
ear		2	1		1		
teeth							
circulatory system		1			1		
respiratory system		36	31		5		
digestive system		48	48				
urinary and genital system		8	7		1		
locomotive system		1	1				
integumentary system		25	22		1		2
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	2	57	55		1		3
Total	3	266	243		19		7

Kearsarge, 3d rate. Wood; screw; 695 tons.

[Employed during the year on the Asiatic Station, arriving home in the fourth quarter, 1877. Average number of ship's company, 179 +; total sick-days, 2,795; deaths, 2; ratio per thousand of cases treated to effectives, 1,164 +; ratio per thousand of cases treated to effectives, 1876, 1,740 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		16	16				
Enthetic	3	30	32		1		
Dietic		9	9				
Diathetic		9	6		3		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		6	3		3		
eye		3	3				
ear							
teeth							
circulatory system		3	1		2		
respiratory system		22	14		4	1	3
digestive system		26	22		3	1	
urinary and genital system	2	7	4		5		
locomotive system		1	1				
integumentary system	2	35	33		1		
Non-malignant tumors and cysts		5	5				
Wounds, injuries, and accidents	1	37	38				
Total	8	209	187		22	*2	6

* One drowning; one acute dysentery.

Monocacy, 3d rate. Iron; paddle; 746 tons.

[During the year employed on the Asiatic Station. Average number of ship's company, 124; total sick days, 1,358; deaths, 0; ratio per thousand of cases treated to effectives, 959 +; ratio per thousand of cases treated to effectives, 1876, 555 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		10	10				
Enthetic		11	8	1	2		
Dietic		1	1				
Diathetic	1	3	4				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		5	4		1		
eye		2	2				
ear		2	2				
teeth							
circulatory system							
respiratory system		7	5		1		1
digestive system	1	31	26	1	3		2
urinary and genital system		10	9		1		
locomotive system							
integumentary system	1	10	11				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		24	22		1		1
Total	3	116	104	2	9		4

Ashuelot, 3d rate. Iron; paddle; 786 tons.

[Employed during the year on the Asiatic Station. Average number of ship's company, 141; total sick-days, 1,288; deaths, 0; ratio per thousand of cases treated to effectives, 1,099 +; ratio per thousand of cases treated to effectives, 1876, 1,184 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		31	27	1	2		1
Enthetic	1	24	22		3		
Dietic		1	1				
Diathetic		15	13		2		
Developmental							
Tubercular							
Parasitic		1	1				
Of the nervous system		4	3		1		
eye		6	6				
ear							
teeth							
circulatory system							
respiratory system		8	6		1		1
digestive system		31	29		2		
urinary and genital system		8	8				
locomotive system							
integumentary system	1	4	5				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		20	18		1		1
Total	2	153	139	1	12		3

Alert, 3d rate. Iron; screw; 541 *tons.*

[Employed during the year on the Asiatic Station. Average number of ship's company, 121 +; total sick-days, 1,297; deaths, 2; ratio per thousand of cases treated to effectives, 1,162 +; ratio per thousand of cases treated to effectives, 1876, 813.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		11	9		2		
Enthetic	1	9	6		4		
Dietic		3	3				
Diathetic	1	18	14		5		
Developmental							
Tubercular							
Parasitic							
Of the nervous system	1	5	5		1		
eye		3	3				
ear							
teeth							
circulatory system		1	1				
respiratory system	1	8	6		1		2
digestive system	1	28	29				
urinary and genital system		3	3				
locomotive system							
integumentary system		4	4				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		43	35		6	2	
Total	5	136	118		19	*2	2

* One fracture of cranium; one pistol-shot wound of head.

Ranger, 3d rate. Iron; screw; 541 *tons.*

[Employed during the year on the Asiatic Station. Average number of ship's company, 144; total sick-days, 1,341; deaths, 2; ratio per thousand of cases treated to effectives, 1,171 +; ratio per thousand of cases treated to effectives, 1876, 14 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		20	13		4	2	1
Enthetic		5	5				
Dietic		3	3				
Diathetic		12	8		4		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		13	9		4		
eye		1		1			
ear		2	2				
teeth							
circulatory system		1			1		
respiratory system		27	23		4		
digestive system		35	34		1		
urinary and genital system		3	3				
locomotive system		2	2				
integumentary system		21	21				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		24	21		2		1
Total		169	144	1	20	2	2

Yantic, 3d rate. Wood; screw; 410 *tons.*

[Employed during the first and second quarters 1877 on Asiatic Station and *en route* home via the Cape of Good Hope, 181 days. Average number of ship's company, 81; total sick-days, 462; deaths, 2; ratio per thousand of cases treated to effectives, 488+; ratio per thousand of cases treated to effectives, 1876, 1,637+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	4	4	......	......	......	......
Enthetic	......	2	2	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	1	1	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	......	2	2	......	......	......	......
eye	......	1	1	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	3	2	......	......	1	......
digestive system	2	7	8	......	......	1	......
urinary and genital system	......	2	1	1	......	......	......
locomotive system	......	2	1	1	......	......	......
integumentary system	......	7	7	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	7	7	......	......	......	......
Total	2	39	37	2	......	*2	......

* One, croupous pneumonia; one, cancer of rectum.

Palos, 4th rate. Iron; screw; 306 *tons.*

[Employed during the year on the Asiatic Station. Average number of ship's company, 47; total sick-days, 139; deaths, 1; ratio per thousand of cases treated to effectives, 510+; ratio per thousand of cases treated to effectives, 1876, 1,260+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	2	1	......	......	1	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	3	3	......	......	......	......
Diathetic	......	......	......	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	2	2	......	......	......	......
digestive system	1	9	9	......	1	......	......
urinary and genital system	......	1	1	......	......	......	......
locomotive system	......	1	1	......	......	......	......
integumentary system	......	1	1	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	3	3	......	......	......	......
Total	1	23	22	......	1	*1	......

* Febris remittens.

SPECIAL SERVICE.

During the year 1877 the vessels employed on special service were: Michigan, Tallapoosa, Gettysburg, Rio Bravo, Guard, and Portsmouth.

Nothing special is to be observed beyond the determination of the disease-rates of these vessels.

The usual tables are appended.

The death was from gun shot wound.

First quarter, 1877. *Special service.*

[Aggregate: Total number of ships' companies, 245; total number of sick-days, 363; deaths, 0.]

Diseases.	Remaining.	Admitted	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		10	9				1
Enthetic		3	3				
Dietic		2	2				
Diathetic	2	3	4		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1	1				
eye							
ear		1					1
teeth							
circulatory system		1	1				
respiratory system		10	8		2		
digestive system		12	10		1		1
urinary and genital system		1					1
locomotive system		1	1				
integumentary system	1	3	3				1
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	1	11	12				
Total	4	60	55		4		5

Second quarter, 1877. *Special service.*

[Aggregate: Total number of ships' companies, 251; total number of sick-days, 316; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	9	9		1		
Enthetic		8	6		1		1
Dietic							
Diathetic		2	2				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		4	4				
eye							
ear	1		1				
teeth							
circulatory system							
respiratory system		5	4		1		
digestive system	1	15	15				1
urinary and genital system	1	3	4				
locomotive system							
integumentary system	1	10	10				1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		11	10				1
Total	5	67	65		3		4

Third quarter, 1877. Special service.

[Aggregate: Total number of ships' companies, 354; total number of sick-days, 615; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	15	14	.....	1	.....	.....
Enthetic	1	7	6	.....	1	.....	1
Dietic	.....	1	1	.....	.....	.....	.....
Diathetic	.....	5	5	.....	.....	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	8	7	.....	1	.....	.....
eye	.....	.....	.....	.....	.....	.....	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	1	1	.....	.....	.....	.....
circulatory system	.....	1	.....	.....	1	.....	.....
respiratory system	.....	10	6	.....	1	.....	3
digestive system	1	14	13	.....	2	.....	.....
urinary and genital system	.....	2	2	.....	.....	.....	.....
locomotive system	.....	.....	.....	.....	.....	.....	.....
integumentary system	1	11	12	.....	.....	.....	.....
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	1	10	10	.....	.....	.....	1
Total	4	85	77	.....	7	.....	5

Fourth quarter, 1877. Special service.

[Aggregate: Total number of ships' companies, 545; total number of sick-days, 751; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	18	18	.....	.....	.....	.....
Enthetic	1	8	6	.....	2	.....	1
Dietic	.....	5	4	.....	1	.....	.....
Diathetic	.....	10	5	.....	3	.....	2
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	5	5	.....	.....	.....	.....
eye	.....	.....	.....	.....	.....	.....	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	1	1	.....	.....	.....	.....
circulatory system	.....	2	1	.....	1	.....	.....
respiratory system	3	17	17	.....	1	.....	2
digestive system	.....	13	9	.....	3	.....	1
urinary and genital system	.....	3	2	.....	1	.....	.....
locomotive system	.....	1	1	.....	.....	.....	.....
integumentary system	.....	12	12	.....	.....	.....	.....
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	1	22	22	.....	.....	*1	.....
Total	5	117	103	.....	12	1	6

* Vul. sclopet. Murdered on shore.

Special service.

AGGREGATE, 1877.

[Average number of ships' companies, 348+; total sick days, 2,045; deaths, 1; ratio per thousand of cases treated to effectives, 972+, 860+ in 1876.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		52	50		2		
Enthetic		26	21		4		1
Dietic		8	7		1		
Diathetic	2	20	16		4		2
Developmental							
Tubercular							
Parasitic							
Of the nervous system		18	17		1		
eye		1	1				
ear							
teeth		2	2				
circulatory system		4	2		2		
respiratory system		42	35		5		2
digestive system		54	47		6		1
urinary and genital system		9	8		1		
locomotive system		2	2				
integumentary system	1	36	37				
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	1	54	54			*1	
Total	4	329	300		26	1	6

Michigan, 3d rate. Iron; paddle; 450 tons.

[Employed on the lakes. Average number of ship's company, 100; total sick-days, 112; deaths, 0; ratio per thousand of cases treated to effectives, 270; ratio per thousand of cases treated to effectives in 1876, 1,093.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		7	7				
Enthetic							
Dietic							
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		2	2				
eye							
ear							
teeth		1	1				
circulatory system							
respiratory system		9	9				
digestive system		3	3				
urinary and genital system		1	1				
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		2	2				
Total		27	27				

Tallapoosa, 4th rate. Wood; paddle; 650 tons.

[Employed on the North Atlantic Station during the year. Average number of ship's company, 367; total sick-days, 100; deaths, 0; ratio per thousand of cases treated to effectives, 640; ratio per thousand of cases treated to effectives in 1876, 830.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	10	8	......	2	......	......
Enthetic	......	9	5	......	4	......	......
Dietic	......	2	2	......	......	......	......
Diathetic	......	5	3	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	4	3	......	1	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	......	......	1	......	......
respiratory system	......	6	2	......	4	......	......
digestive system	......	13	8	......	5	......	......
urinary and genital system	......	1	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	2	2	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	1	11	12	......	......	......	......
Total	1	63	45	......	19	......	......

Gettysburg, 4th rate. Iron; paddle; 518 *tons.*

[Employed on special service on the European Station. Average number of ship's company, 100+; total sick-days, 835; deaths, 0; ratio per thousand of cases treated to effectives, 1,296+; ratio per thousand of cases treated to effectives in 1876, 1,041+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	16	16	......	......	......	......
Enthetic	......	7	7	......	......	......	......
Dietic	2	10	10	......	1	......	1
Diathetic	......	......	......	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	5	5	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	1	1	......	......	......	......
teeth	......	1	1	......	......	......	......
circulatory system	......	2	2	......	......	......	......
respiratory system	......	20	18	......	1	......	1
digestive system	......	29	29	......	......	......	......
urinary and genital system	......	5	5	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	1	15	16	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	16	16	......	......	......	......
Total	3	127	126	......	2	......	2

Rio Bravo, 4th rate. Paddle; 325 tons.

[Stationed at Brownsville, Tex. Average number of ship's company, 44+; total sick-days, 634; deaths, 1; ratio per thousand of cases treated to effectives, 1,452+; ratio per thousand of cases treated to effectives, 1876, 1,591+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		14	14				
Enthetic		7	6				1
Dietic		4	4				
Diathetic		2	2				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		3	3				
eye							
ear							
teeth							
circulatory system							
respiratory system		3	3				
digestive system		3	3				
urinary and genital system		2	2				
locomotive system		2	2				
integumentary system		14	14				
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents		11	10			1	
Total		66	64			*1	1

Vul. sclop. Murdered on shore.

Guard, 4th rate. Wood; sails; 925 tons.

[Engaged during the fourth quarter 1877 on surveying duty in European waters (92 days). Average number ship's company, 98; total sick-days, 87; deaths, 0; ratio per thousand of cases treated to effectives.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic		3	3				
Dietic							
Diathetic		1			1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system		2	2				
digestive system		3	2		1		
urinary and genital system		1			1		
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		5	5				
Total		17	14		3		

Portsmouth, 3d rate. Wood; sails; 846 tons.

[During the fourth quarter 1877 (83 days), was *en route* from California to Washington. Average number of ship's company, 96; total sick-days, 110; deaths, 0; ratio per thousand of cases treated to effectives, 302+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	3	3	......	......	......	......
Enthetic	......	......	......	......	......	......	......
Dietic	......	2	1	......	1	......	......
Diathetic	......	1	......	......	......	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	4	4	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	......	......	1	......	......
respiratory system	......	2	1	......	......	......	1
digestive system	......	3	2	......	......	......	1
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	4	4	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	9	9	......	......	......	......
Total	......	29	24	......	2	......	3

SCHOOL AND PRACTICE SHIPS.

The vessels employed in this service were the Constitution, Minnesota, Constellation, Saratoga, Supply, and Mayflower.

The usual tables are appended.

The deaths were one from rupture of the heart, and one from drowning.

During the first quarter an epidemic of cynanche parotidæa, occurred on the Minnesota at New York numbering 10 recorded cases; no history of the epidemic has been received. At the same time the Trenton was affected as has been mentioned hereinbefore.

First quarter, 1877. Training and practice ships.

[Aggregate: Total number of ships' companies, 493; total number of sick-days, 763; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	5	4	......	1	......	......
Enthetic	1	3	4	......	......	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	1	4	3	......	1	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	2	2	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	19	16	......	1	......	2
digestive system	......	32	28	......	2	......	2
urinary and genital system	......	1	......	......	......	......	1
locomotive system	......	......	......	......	......	......	......
integumentary system	2	13	13	1	......	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	1	13	13	......	......	......	1
Total	5	93	84	1	5	......	8

Second quarter, 1877. Training and practice ships.

[Aggregate: Total number of ships' companies, 1,117; total number of sick-days, 938; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	14	12	......	1	......	1
Enthetic	......	3	3	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	1	11	10	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	10	9	......	1	......	......
eye	......	......	......	......	......	......	......
ear	......	1	1	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	2	17	17	......	2	......	......
digestive system	2	21	18	......	......	......	5
urinary and genital system	1	4	3	......	......	......	2
locomotive system	......	1	......	......	......	......	1
integumentary system	1	14	14	......	......	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	1	49	38	......	4	......	8
Total	8	145	125	......	10	......	18

Third quarter, 1877. Training and practice ships.

[Aggregate: Total number of ships' companies, 1,453; total number of sick-days, 1,826; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	19	20	.....	.....	.....	.....
Enthetic	.....	8	7	.....	1	.....	.....
Dietic	.....	2	1	.....	1	.....	.....
Diathetic	.....	12	9	.....	2	.....	1
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	15	11	1	3	.....	.....
eye	.....	18	18	.....	.....	.....	.....
ear	.....	2	1	.....	.....	.....	1
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	1	.....	.....	1	.....	.....
respiratory system	.....	14	12	.....	2	.....	.....
digestive system	5	35	37	.....	3	.....	.....
urinary and genital system	2	4	4	.....	2	.....	.....
locomotive system	1	3	4	.....	.....	.....	.....
integumentary system	1	29	27	.....	1	.....	2
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	8	80	74	1	3	*1	9
Total	18	242	225	2	19	1	13

* Drowned.

Fourth quarter, 1877. Training and practice ships.

[Aggregate: Total number of ships' companies, 1,004; total number of sick-days, 1,219; deaths, 1.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	13	10	.....	2	.....	1
Enthetic	.....	5	2	.....	2	.....	1
Dietic	.....	2	2	.....	.....	.....	.....
Diathetic	1	6	5	1	1	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	.....	.....	.....	.....	.....	.....
Of the nervous system	.....	6	5	1	.....	.....	.....
eye	.....	5	2	.....	3	.....	.....
ear	1	1	1	1	.....	.....	.....
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	4	.....	1	2	*1	.....
respiratory system	.....	12	11	.....	.....	.....	1
digestive system	.....	12	9	.....	2	.....	1
urinary and genital system	.....	1	.....	.....	1	.....	.....
locomotive system	.....	3	2	.....	.....	.....	1
integumentary system	2	17	18	.....	.....	.....	1
Non-malignant tumors and cysts	.....	1	1	.....	.....	.....	.....
Wounds, injuries, and accidents	9	48	48	1	4	.....	4
Total	13	136	116	5	17	1	10

* Rupture of heart.

Training and practice ships.

AGGREGATE, 1877.

[Average number of ships' companies, 1,014¼; total sick-days, 4,746; deaths, 2; ratio per thousand of cases treated to effectives, 612+; ratio per thousand of cases treated to effectives, 1876, 345+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		51	46		4		1
Enthetic	1	19	16		3		1
Dietic		5	4		1		
Diathetic	1	33	27	1	6		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		33	27	2	4		
eye		23	20		3		
ear		4	3	1			
teeth							
circulatory system		5		1	3	*1	
respiratory system		62	56		5		1
digestive system		100	92		7		1
urinary and genital system		10	7		3		
locomotive system		7	6				1
integumentary system	2	73	72	1	1		1
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents	1	190	173	2	11	†1	4
Total	5	616	550	8	51	2	10

*Rupture of heart. †Drowned.

Constitution, 3d rate. Wood; sails; 1,335 tons.

[Employed as training-ship at Philadelphia for 353 days of 1877. Average number of ship's company, 203; total sick-days, 1,131; deaths, 0; ratio per thousand of cases treated to effectives, 846+.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		22	22				
Enthetic		4	2		2		
Dietic		1					1
Diathetic		8	8				
Developmental							
Tubercular							
Para itic							
Of the nervous system		5	4		1		
eye		6	5		1		
ear		2	1				1
teeth							
circulatory system							
respiratory system		18	17		1		
digestive system		18	18				
urinary and genital system		2	2				
locomotive system		4	3				1
integumentary system		30	30				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		52	51				1
Total		172	163		5		4

Minnesota, 1st rate. *Wood; screw; 3,000 tons.*

[Employed as training-ship at New York, N. Y. Average number of ship's company, 401; total sick days, 1,799; deaths, 1; ratio per thousand of cases treated to effectives, 515; ratio per thousand of cases treated to effectives in 1876, 365 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	15	11	......	3	......	1
Enthetic	1	6	6	......	......	......	1
Dietic	......	1	1	......	......	......	......
Diathetic	1	12	7	1	5	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	10	8	1	1	......	......
eye	......	2	1	......	1	......	......
ear	......	2	1	1	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	......	1	......	1	......
respiratory system	......	22	19	......	2	......	1
digestive system	......	45	40	......	4	......	1
urinary and genital system	......	2	2	......	......	......	......
locomotive system	......	2	2	......	......	......	......
integumentary system	2	20	20	1	......	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	1	61	57	1	3	......	1
Total	5	202	175	6	19	*1	6

* Rupture of heart.

Mayflower, 4th rate. *Screw; 306 tons.*

[Was employed for 182 days (second and third quarters), in 1877, as a practice-vessel, with cadet engineers. Average number of ship's company, 36; total sick-days, 50; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	......	......	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	......	......	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	1	1	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	1	......	......	1	......	......
digestive system	1	8	9	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	......	......	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	3	3	......	......	......	......
Total	1	13	12	......	1	......	......

Saratoga, 4th rate. Wood; sails; 757 tons.

[Employed for 225 days (part of second and all of third and fourth quarters) as training-ship at Boston and Norfolk. Average number of ship's company, 204⅔; total sick-days, 717; deaths, 0; ratio per thousand of cases treated to effectives.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		7	6		1		
Enthetic		4	4				
Dietic							
Diathetic		6	6				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		3	2	1			
eye		1			1		
ear							
teeth							
circulatory system		3			3		
respiratory system		8	8				
digestive system		11	10		1		
urinary and genital system		4	2		2		
locomotive system							
integumentary system		4	4				
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents		35	26		7		2
Total		87	69	1	15		2

Supply, 4th rate. Wood; sails; 547 tons.

[Employed for 145 days (second and third quarters), 1877, as practice-ship. Average number of ship's company, 170; total sick-days, 205; deaths, 1; ratio per thousand of cases treated to effectives, 200; ratio per thousand of cases treated to effectives in 1876, 226.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic							
Dietic		2	1		1		
Diathetic							
Developmental							
Tubercular							
Parasitic							
Of the nervous system		5	3		2		
eye							
ear							
teeth							
circulatory system							
respiratory system							
digestive system		2	2				
urinary and genital system							
locomotive system							
integumentary system		9	9				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		14	13			*1	
Total		34	30		3	1	

*Drowned.

Constellation, 3d rate. Wood; sails; 1,236 tons.

[Was employed as practice-ship for 112 days (second and third quarters) in 1877. The average ship's company, 300; total sick-days, 667; deaths, 0; ratio per thousand of cases treated to effectives, 360.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	5	5	......	......	......	......
Enthetic	......	6	5	......	1	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	7	6	......	1	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	9	9	......	......	......	......
eye	......	14	14	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	13	12	......	1	......	......
digestive system	......	16	14	......	2	......	......
urinary and genital system	......	2	1	......	1	......	......
locomotive system	......	1	1	......	......	......	......
integumentary system	......	10	9	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	25	23	1	1	......	......
Total	......	108	99	1	8	......	......

COAST SURVEY.

The vessels employed on the Coast Survey Service from which returns have been received were the Gedney and Bache.

These vessels are officered and manned from the Navy.

The Gedney was employed on the coast of Florida, and the Bache was at the navy-yard, Washington.

The usual tables are appended.

First quarter, 1877. Coast Survey.

[Aggregate: Total number of ships' companies, 33; total number of sick-days, 25; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	......	......	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	......	......	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	1	1	......	......	......	......
digestive system	......	1	1	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	3	3	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	......	......	......	......	......	......
Total	......	5	5	......	......	......	......

Second quarter, 1877. *Coast Survey.*

[Aggregate: Total number of ships' companies, 59; total sick-days, 62; deaths, 0.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	2	2	......	......	......	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	6	6	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	1	1	......	......	......	......
eye	......	1	1	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	2	2	......	......	......	......
digestive system	......	2	2	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	1	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and cysts	......	......	......	......	......	......	......
Total	......	16	16	......	......	......	......

Coast Survey.

AGGREGATE, 1877.

[Average number of ships' companies, 30+; total sick-days, 135; deaths, 0; ratio per thousand of cases treated to effectives, 692; ratio per thousand of cases treated to effectives, 1,036 in 1876.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	2	2	......	......	......	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	6	6	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	1	1	......	......	......	......
eye	......	1	1	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	3	3	......	......	......	......
digestive system	......	3	3	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	4	4	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	......	......	......	......	......	......
Total	......	21	21	......	......	......	......

Gedney, Coast Survey steamer.

[During the first and second quarters (181 days) was employed near Saint Andrew's, Fla. Average number of ship's company, 32 +; total sick-days, 98; deaths, 0; ratio per thousand of cases treated to effectives, 553 +; ratio per thousand of cases treated to effectives, 1876, 500 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic		1	1				
Dietic							
Diathetic		5	5				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1	1				
eye							
ear							
teeth							
circulatory system							
respiratory system		3	3				
digestive system		2	2				
urinary and genital system							
locomotive system							
integumentary system		4	4				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents							
Total		18	18				

Bache, Coast Survey.

[During the second quarter, 1877, was employed at Washington. Average number of ship's company, —; total sick-days, —; deaths, —; ratio per thousand of cases treated to effectives, 81 +; ratio per thousand of cases treated to effectives, 1876, 677 +.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic							
Dietic							
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system							
digestive system		1	1				
urinary and genital system							
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents							
Total		3	3				

RÉSUMÉ.

The total sick-rate for the year was 891 + per thousand of effectives; that of the previous year was 700 +.

The mortality from disease was 18. The mortality from wounds, injuries, and accidents was 107; 103 from drowning, 2 from fracture of the cranium, 2 from gunshot wounds.

A general aggregate of the total diseases and casualties, with a graphic representation of the sick-rate of the various stations and a station map suggesting attention to disease zones, are herewith appended.

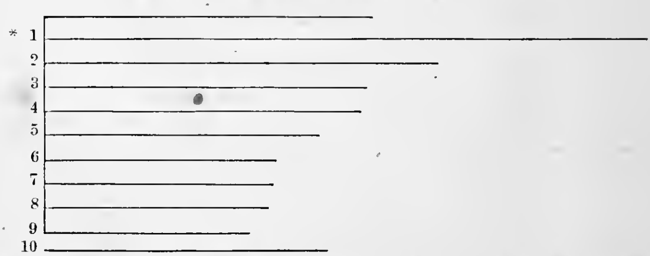
General aggregate for the year 1877.

[Average number of men, 7,461; total sick-days, 57,936; deaths, 125; ratio per thousand of cases treated to effectives, 891+].

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	8	798	744	2	40	5	15
Enthetic	29	498	439	2	69	......	17
Dietic	1	141	137	1	2	......	2
Diathetic	16	493	404	2	94	......	9
Developmental	......	3	......	......	2	......	1
Tubercular	......	2	......	......	2	......	......
Parasitic	......	10	10	......	......	......	......
Of the nervous system	8	305	268	5	38	......	2
eye	......	116	102	2	9	......	3
ear	......	37	28	2	4	......	3
teeth	......	8	8	......	......	......	......
circulatory system	......	73	24	2	42	5	......
respiratory system	10	619	506	4	94	*6	19
digestive system	11	1,026	964	2	60	2	9
urinary and genital system	4	201	168	......	33	......	4
locomotive system	1	35	25	......	10	......	1
integumentary system	18	769	739	4	28	......	16
Non-malignant tumors and cysts	......	13	13	......	......	......	......
Wounds, injuries, and accidents	23	1,475	1,296	5	65	107	25
Total	129	6,622	5,875	33	592	125	126

* One case drowned.

Average number of men.



Graphic representation of the health of the Navy for the year 1877, as determined by the sick-rate per thousand, *i. e.*, the ratio per thousand of cases treated to effectives.

*1.	South Pacific Station	1,948 +
2.	Asiatic	1,230 +
3.	European	984 +
4.	Special service	972 +
5.	North Pacific	839 +
6.	North Atlantic	708 +
7.	South Atlantic	697 +
8.	Coast Survey	692 +
9.	School and training vessels	612 +
10.	Sick-rate for the year	904 +

A.—*Annual statement compiled from sick-reports from naval stations and vessels in commission on home and foreign service for the year ending December 31, 1877.*

	Average number on board in 1877.	Remaining sick December 31, 1876.	Admitted in 1877.	Discharged in 1877.	Died in 1877.	Total treated in 1877.	Remaining sick December 31, 1877.	Percentage of deaths to number treated.
Hospitals.								
Chelsea, Mass	....	15	66	51	3	81	27	....
Brooklyn, N. Y	....	33	196	170	11	229	48	....
Philadelphia, Pa	....	20	98	81	11	118	26	....
Washington, D. C	....	9	130	119	7	139	13	....
Norfolk, Va	....	26	279	248	11	305	46	....
Pensacola, Fla	....	2	20	18	....	22	4	....
Mare Island, Cal	....	43	117	111	8	160	41	....
Yokohama, Japan	....	7	68	69	1	75	5	....
Total	....	155	974	867	52	1,129	210	.04
Navy-yards and stations.								
Portsmouth, N. H	....	3	79	78	1	82	3	....
Boston, Mass	....	4	166	167	....	170	3	....
Brooklyn, N. Y	....	....	55	55	....	55	....	....
League Island, Pa	....	1	16	16	1	17	....	....
Washington, D. C	....	3	206	206	....	209	3	....
Norfolk, Va	....	3	150	150	1	153	2	....
Pensacola, Fla	....	2	20	22	....	22	....	....
Mare Island, Cal	....	2	39	38	1	41	2	....
Torpedo Station, Newport	....	2	40	42	....	42	....	....
Naval Academy	....	11	1,020	1,011	1	1,031	19	....
Marine Barracks, N. Y	....	12	225	228	....	237	9	....
Marine Barracks, Washington	....	....	227	225	2	227	....	....
Total	....	43	2,243	2,238	7	2,286	41	.003
Receiving-ships.								
Boston, Mass	210	2	83	81	1	85	3	....
Brooklyn, N. Y	403	3	170	167	1	173	5	....
League Island, Pa	175	....	72	68	1	72	3	....
Washington, D. C	100	....	102	99	2	102	1	....
Norfolk, Va	165	....	145	142	....	145	3	....
Mare Island, Cal	95	....	46	41	2	46	3	....
Total	1,148	5	618	598	7	623	18	.01

SUMMARY OF VESSELS IN COMMISSION.

Average number of persons on board in 1877	7,461
Remaining sick December 31, 1866	129
Admitted to sick-list in 1877	6,622
Discharged from sick-list in 1877	6,500
Died in 1877	125
Total treated in 1877	6,748
Remaining sick December 31, 1877	126
Proportion of cases to number of persons on board	.90
Proportion of deaths to number of persons on board	.016
Proportion of deaths to number of cases treated	.018

RECAPITULATION.

	Average number of officers and men on board in 1877.	Remaining sick December 31, 1876.	Admitted in 1877.	Discharged in 1877.	Died in 1877.	Total treated in 1877.	Remaining sick December 31, 1877.	Proportion of cases to number of persons on board.	Proportion of deaths to number of persons on board.	Proportion of deaths to number of persons treated.
Naval hospitals	....	155	974	867	52	1,129	210	....	....	.04
Yards and stations	....	43	2,243	2,238	7	2,286	41	....	....	.003
Receiving-ships	1,148	5	618	598	7	623	18	.50	.007	.01
Vessels in commission at sea	7,461	129	6,622	6,500	125	6,751	126	.90	.016	.018
Total	8,609	332	10,457	10,203	191	10,789	395	1.02	.02	.02

At the close of the year 1876, there remained under treatment 332 cases; during the year 1877 there occurred 10,457 cases of disease, injury, &c., making a total of 10,789 cases treated during the year; of which number 191 died and 10,203 were returned to duty or discharged the service, leaving 395 cases under treatment at the close of the year 1877.

The average strength of the Navy (officers, seamen, marines, engineer service, and Coast Survey included) for the year 1877, as near as can be ascertained, was 8,609. The proportion of cases admitted to the whole number of persons in the service, was about 1.02, or each person was on the sick-list $1\frac{2}{100}$ times during the year. The proportion of deaths to the whole number of persons in the service was .02, and the proportion of deaths to the number of cases treated was .02.

Of the 191 deaths during the year, 98 were from drowning from the wreck of United States steamer Huron, November 24.

The total number of deaths from all causes reported to the Navy Department, from October 1, 1877, to October 1, 1878, was 197.

INSANE OF THE NAVY.

On the 30th September, 1877, there remained under treatment in the Government Hospital for the Insane 2 commanders, 2 lieutenant-commanders, 1 assistant engineer, 1 late ensign, 9 seamen, 1 ordinary seaman, 2 ordinary seamen extra, 1 seaman extra fireman, 1 late seaman, 8 landsmen, 7 marines, 3 beneficiaries, 1 second-class boy; total 39

Admitted during the year ending September 30, 1878:

1 assistant engineer retired, 1 seaman, 1 ordinary seaman, 1 landsman, 1 beneficiary, 4 marines; total 9

Total number under treatment during the year 48

Discharged during the year:

By death, 1 beneficiary, 1 marine 2
By recovery, 1 landsman 1
By improvement, 1 landsman, 1 marine 2

Total discharged 5

Remaining at the end of the year:

2 commanders, 2 lieutenant-commanders, 2 first assistant engineers, 1 late ensign, 10 seamen, 2 ordinary seamen, 2 ordinary seamen extra, 1 seaman extra fireman, 1 late seaman, 7 landsmen, 9 marines, 3 beneficiaries, 1 second-class boy; total 43

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1877.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast Survey.		Total.	
Aggregate number of men	1,764		939		1,089		830		1,447		348		1,014		30		7,461	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class I.—Zymotic diseases:																		
Order I.—Miasmatic diseases:																		
Catarrhus epidemicus	8								3								11	
Cholera communis					1				6	2							7	2
Cynanche parotidea					23								2				25	
Dengnis							1										1	
Diphtheria							1										1	
Erysipelas	1	1	4		2		2		1		1						11	1
Febris continua simplex	6		16		45		3		9		11		6				96	
Febris enterica	3				1		1		2								7	
Febris flava											3						3	
Febris intermittens	105		42		39		78		126		32		36		2		460	
Febris recidiva					1						2						3	
Febris remittens	26		3	1	7		80		23	1							139	2
Morbilli	6																6	
Rubeola											3						3	
Scarlatina	1																1	
Varicella	1												1				2	
Variola					2												2	
Varioloides									2				1				3	
Febricula									5								5	
Feb. chagres	7																7	
Feb. incertus	2																2	
Vaccinia					6								5				11	
Order II.—Enthetic diseases:																		
Syphilis primitiva	49		24		30		23		63		11		7				207	
Syphilis consecutiva	24		18		18		12		54		6		3				135	
Gonorrhoea	43		14		21		35		49		8		10		1		181	
Ophthalmia gonorrhöica									1								1	
Balanitis					1												1	
Bubo					1												1	
Verruca											1						1	

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1877—Continued.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast Survey.		Total.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class I.—Zymotic diseases—Continued.																		
Order III.—Dietic diseases:																		
Alcoholismus	10		9		14		54		12		6		4				109	
Delirium tremens	4		1		3		1		6		1		1				17	
Ebriositas			1		1				13		1						16	
Class II.—Constitutional diseases:																		
Order I.—Diathetic diseases:																		
Adynamia	19		6		21		10		33		7		7				103	
Anæmia	1						1		4				2				8	
Gangræna senilis			1														1	
Hydrops											1						1	
Podagra			4												2		6	
Rheumatismus acutus	40		19		22		29		85		12		17		2		226	
Rheumatismus chronicus	24		15		23		41		46				8		2		159	
Rheumatismus musculorum			1														1	
Anasarca	1																1	
Debilitas	1																1	
Order II.—Developmental diseases:																		
Degeneratio							1										1	
Senectus			1				1										2	
Order III.—Tubercular diseases:																		
Tuberculosis	2																2	
Class III.—Parasitic diseases:																		
Scabies			1						3								4	
Vermes	1		1		2				1								5	
Filaria medinensis	1																1	
Class IV.—Local diseases:																		
Order I.—Diseases of the nervous system:																		
Apoplexia			1						3								4	
Cephalalgia	6		4		20		1		14		8		11				64	
Sciatica	1												3				4	
Dementia					1		2		1				1				5	
Epilepsia	6		8		1		4		4		1		4				28	
Insolatio	7		1						9								17	
Irritatio spinalis			1				1								1		3	
Mania							2		1								3	

Melancholia	1		1				1						3				6	
Meningitis													1				1	
Myelitis	1																1	
Neuralgia	23		9		50		28		34		9		7				160	
Paralysis			2		1								2				5	
Myalgia			2														2	
Lumbago					2												2	
Vertigo									1				1				2	
Heat exhaustion									2								2	
Torticollis									2								2	
Aphasia					1												1	
Insanity					1												1	
Order II.—Diseases of the eye:																		
Amaurosis					1								3				4	
Cataracta					1												1	
Conjunctivitis	13		8		12		3		25		1		4				66	
Fistula lachrymalis							1										1	
Sclerotitis					1												1	
Iritis	3		4		1		3						2		1		14	
Ophthalmia	1				1		1		5				12				20	
Retinitis													2				2	
Keratitis					1		1		1								3	
Hordeolum			1		1				1								3	
Ulcus cornea			1														1	
Order III.—Diseases of the ear:																		
Otalgia	1						2		5								8	
Otitis	2		2		2		1		8				3				18	
Otorrhœa	2				1		3		3				1				10	
Surditas					1												1	
Order IV.—Diseases of the teeth:																		
Odontalgia	1				2		1		2		2						8	
Order V.—Diseases of the circulatory system:																		
Aneurysma	1	1			2								1				4	1
Angina pectoris							1	1									1	1
Morbi valvularum cordis	4		1		4	1	2		2				3				16	1
Palpitatio	9		4		1		4		7		3						28	
Pericarditis	1		4	1			1				1						7	1
Phlebitis			1														1	
Varix	1						1		8								10	
Angeioleucitis	1																1	
Syncope					1												1	
Hyperæmia					1												1	
Vertigo					1												1	
Rupture of heart													1	1			1	1
Order VI.—Diseases of the respiratory system:																		
Apnœa													1				1	
Asthma	3				6	1	2										11	1
Bronchitis acuta	36		10		31	1	15		48		8		17		2		167	1
Bronchitis chronica	16	1	12		8		6		10				10				62	1
Catarrhus	37		16		55		24	1	72	1	23		23				250	2
Hydrothorax	2																2	
Laryngitis	1		2						2				1		1		7	

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1877—Continued.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast Survey.		Total.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class IV.—Local diseases—Continued.																		
Order VI.—Diseases of the respiratory system—Cont'd.																		
Phthisis pneumonica acuta	2								6		2						10	
Phthisis pneumonica chronica	14		3		4		4		5		3		1				34	
Pleuritis	9		9		13		7		3		2		6				49	
Pneumonia	5		4		4		2		7	1	2		3				27	1
Hæmoptysis					1				6		1						8	
Emphysema									1		1						2	
Order VII.—Diseases of the digestive system:																		
Cholera morbus	12		2		23		11		35		3		3				89	
Cirrhosis hepatis	2																2	
Colica	12		6		16		17		37		5		2				95	
Constipatio	5		2		2		3		15		2		2		1		31	
Diarrhœa acuta	45		17		62		43		130	1	20		28		1		347	1
Diarrhœa chronica	6		1		1		3		5	1			1				17	1
Dysenteria acuta	32		20		3		1		22		5		3				86	
Dysenteria chronica	4								3				1				8	
Dyspepsia	3		3		11		4		12		2		4				39	
Enteritis	1				1						1						3	
Fistula in ano			1						3		1						5	
Gastritis	6						9		3				1				19	
Hæmatemesis	1				1				1		1		1				5	
Hæmorrhois	14		11		9		7		11		1		2				55	
Hepatitis acuta	5		1				1		2								9	
Hepatitis chronica	2		1														3	
Icterus	5		1		4		5				1						16	
Peritonitis			1		2												3	
Pharyngitis	2		1		5		6		3		7		8		1		33	
Prolapsus ani	2								1								3	
Splenitis			3														3	
Stomatitis			1				3				2		2				8	
Tonsillitis	14		17		22		13		39		3		30				138	
Gastralgia					6												6	
Parotiditis					1								2				3	
Gastrodynia					1												1	
Parotitis													10				10	

Order VIII.—Diseases of the urinary and genital system:																		
Albuminuria	1				2		2		3								8	
Calculus					1				1				1				3	
Cystitis	1		1				8		2								12	
Dysuria			1						3								4	
Ischuria							1										1	
Nephritis	6				1						1		1				9	
Orchitis	14		15		21		19		42		3		4				118	
Paraphymosis			1		2		2										5	
Phymosis	1						1										2	
Enuresis							1										1	
Hæmaturia	2				1		2										5	
Hydrocele									1		1						2	
Spermatorrhœa	1						1										2	
Urethræ strictura	7		3		1		2		7		3		4				27	
Varicocele							1				1						2	
Atony of bladder									1								1	
Epididymitis			1		1												2	
Order IX.—Diseases of the locomotive system:																		
Arthritis	4		2						1				1				8	
Ankylosis									1								1	
Bursitis			1														1	
Coxalgia									1								1	
Hydrops articulorum	4						1				1						6	
Necrosis	1										1						2	
Ostitis									1								1	
Periostitis	1		1				1										3	
Synovitis	1		1		1				4				5				12	
Myositas					1												1	
Rheumatismus colli													1				1	
Order X.—Diseases of the integumentary system:																		
Abscessus	42		17		51		13		66		11		27		1		228	
Adenitis	25		16		9		19		30		5		5				109	
Anthrax	2		3		4		1		2				1				13	
Ecthyma	3								2								5	
Eczema	1		1				4		2		1		4				13	
Erythema	1						2		1								4	
Furunculus	20		29		58		62		69		12		13		3		266	
Herpes			1		3		1				2						7	
Impetigo									1				2				3	
Lichen	3		1				2		2		1		1				10	
Paronychia	9		12		15		13		16		3		10				78	
Pernio	2																2	
Urticaria					1												1	
Cellulitis					1				1								2	
Psoriasis	1						1		2								4	
Unguis involutis	1										1						2	
Ulcus	5		10		4		1		5		1		7				33	
Parotitis									1								1	
Fungoid wart	1																1	
Clavus pedis													1				1	
Onychia													2				2	

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1877—Continued.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		Special and practice.		Coast Survey.		Total.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class IV.—Local diseases—Continued.																		
Order X.—Diseases of the integumentary system:																		
Clavus													2				2	
Class V.—Non malignant tumors and cysts:																		
Adenoma									5		1		1				7	
Angeioma					1												1	
Cystis sebacea									1								1	
Fibroma	1																1	
Osteoma					1												1	
Verruca									1								1	
Bronchocele					1												1	
Class VI.—Violent diseases and deaths:																		
Order I.—Wounds, injuries, and accidents:																		
Abrasio	11		6		10		9		24		2		8				70	
Ambustio	7		6		4		9		13		2		9				50	
Concussio cerebri	1										5						6	
Contusio	52		43		62		58		108		20		61				404	
Fractura	9		5		8		5	1	12	1			11				50	2
Hernia	11		13				1		6		1		9				41	
Luxatio	4		3				4				4		2				17	
Stremma	43		27		51		24		51		4		32				232	
Submersio	100	100	1	1	2	1			1				1	1			105	103
Vulnus contusum	42		20		28		61		59		3		20				233	
Vulnus incisum	20		18		15		16		26		5		16				116	
Vulnus laceratum	6		6		28		19		20		6		10				95	
Vulnus punctum	8		9		3		14		17		2		11				64	
Vulnus sclopetarium	2				1		1		1	1	1	1	1				7	2
Vulnus venenatum	3				1		1		1								6	
Congestio cerebri					1												1	
Total	1,249	103	655	3	1,083	4	1,007	3	1,781	9	331	1	621	2	21		6,748	125

No. 8.—BUREAU OF PROVISIONS AND CLOTHING.

NAVY DEPARTMENT,
BUREAU PROVISIONS AND CLOTHING,
Washington, October 31, 1878.

SIR: In accordance with instructions contained in your letter of the 22d instant, I have the honor to submit herewith estimates—marked A, B, C, D, and E—for the fiscal year ending June 30, 1880, together with schedules numbered 1 to 5, inclusive, and statement No. 6, pertaining to the operations of this bureau during the year ending June 30, 1878.

I respectfully renew the recommendation of my predecessor that assistant paymasters of the Navy be placed on the same footing as the assistant surgeons of the Navy are at present (per act of March 1, 1871), and be made eligible for promotion to the grade of passed assistant paymaster after three years' service.

Very respectfully, your obedient servant,

GEO. F. CUTTER,
Paymaster-General United States Navy.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Bureau of Provisions and Clothing.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
A.—EXPENSES OF THE BUREAU OF PROVISIONS AND CLOTHING.		
For salary of chief clerk, per act July 5, 1862 (12 Stat. at L., p. 511, sec. 3)	$1,800 00	
For salary of one clerk of class four, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	1,800 00	
For salary of two clerks of class three, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	3,200 00	
For salary of two clerks of class two, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	2,800 00	
For salary of three clerks of class one, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	3,600 00	
For salary of messenger, per act June 19, 1878 (20 Stat. at L., p. 198)	720 00	
For salary of one laborer, per act June 19, 1878 (20 Stat. at L., p. 198)	660 00	
	14,580 00	$14,580 00
B.—CONTINGENT EXPENSES OF THE BUREAU.		
For blank books, stationery, and miscellaneous items, per act June 19, 1878 (20 Stat. at L., p. 198)	400 00	400 00
C.—PROVISIONS FOR THE NAVY.		
For provisions for crew and marines; commuted rations for officers, crew, and marines; expenses of inspections and storehouses; and for water for ships, per act May 4, 1878 (20 Stat. at L., p. 53)	1,200,000 00	1,200,000 00
D.—CONTINGENT EXPENSES OF THE NAVY UNDER BUREAU OF PROVISIONS AND CLOTHING.		
For freight on shipments, candles, fuel, books and blanks, stationery, advertising and commissions on sales, postage, telegrams, express charges, tolls, ferriage, car-tickets, yeomen's stores, iron safes, newspapers, ice, and other expenses not enumerated, per act May 4, 1878 (20 Stat. at L., p. 53)	35,000 00	35,000 00

Estimates of appropriations required, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
E.—CIVIL ESTABLISHMENT.		
Navy-yard, Boston, Mass.:		
One writer to paymaster	$1,017 25	
One writer to inspector	1,017 25	
Navy-yard, New York, N. Y.:		
One writer to inspector	1,017 25	
One writer to paymaster	1,017 25	
One writer to paymaster	939 00	
Navy-yard, League Island, Pa.:		
One writer to paymaster	1,017 25	
Navy-yard, Washington, D. C.:		
One writer to paymaster	1,300 00	
Navy-yard, Norfolk, Va.:		
One writer to paymaster	1,017 25	
One writer to inspector	1,017 25	
Navy-yard, Mare Island, Cal.:		
One writer to paymaster	1,017 25	
One writer to inspector	1,017 25	
	11,394 25	

Schedule of proposals for fresh provisions, navy bread, baking, and water, received during the fiscal year ending June 30, 1878; the supplies to be delivered during the fiscal year 1878–'79.

Name.	Where to be delivered.	Fresh bread.	Fresh beef.	Vegetables.	Navy bread.	Baking.	Water.
		Per pound.	*Per pound.*	*Per pound.*	*Per pound.*	*Per bbl. of flour.*	*Per gallon.*
J. E. Chase*	Portsmouth, N. H		\$0 06$\frac{9}{10}$	\$0 01			
C. L. Brown*	do	\$0 06*	07	02			
J. W. Hobbs*	Boston, Mass		11	01$\frac{7}{8}$			
H. P. Stevens	do		11$\frac{1}{4}$	02$\frac{1}{4}$			
C. Flanders	do		11	03			
C. F. Austin & Co.*	do	06				\$1 75	
P. Morrison	New York, N. Y		08$\frac{98}{100}$	02			
J. Hanley	do		07$\frac{97}{100}$	01$\frac{1}{4}$			
W. H. Clooner & Co	do		07$\frac{98}{100}$	01			
J. J. Lyons	do		07$\frac{94}{100}$	01$\frac{3}{4}$			
Moses Straus	do		13$\frac{1}{4}$	02$\frac{1}{2}$			
L. J. Tormey*	do		07	01$\frac{1}{4}$			
J. C. De Trainet	do		06$\frac{1}{4}$	01			
J. Camper	do		12$\frac{3}{4}$	03$\frac{1}{4}$			
E. Bradley†	do		06	00$\frac{9}{10}$			
C. T. Goodwin & Son*	do					1 00	
O. Finnegan†	do	03$\frac{3}{4}$					
J. McNamara*	do	04					
F. Fruin	do	06$\frac{1}{2}$					
T. Bradley	League Island, Pa	04$\frac{3}{4}$	09$\frac{45}{100}$	03$\frac{1}{4}$			
L. S. Boraef*	do	04$\frac{7}{10}$	09$\frac{1}{4}$	03$\frac{1}{5}$			
I. S. Ivins & Son*	do					1 44	
J. T. Varnell*	Washington, D. C		05$\frac{1}{4}$	01$\frac{3}{4}$			
J. G. Carroll	do		06$\frac{1}{10}$	01$\frac{1}{4}$			
M. H. Homiller	do		06	02			
W. S. Crown	do		04$\frac{88}{100}$	02$\frac{1}{2}$			
W. H. Robertson	do		06	02$\frac{18}{100}$			
W. E. Kimberly	do		07	02$\frac{1}{4}$			
B. Charlton*	do	04*				2 50	
J. D. Mason & Co*	do					1 00	
C. Tyler	do					1 59	
J. F. Seitz	do	04$\frac{1}{2}$					
W. F. Dann	Norfolk, Va		06$\frac{95}{100}$	02			
I. Gutman	do		07	02			
J. E. Baum*	do		06$\frac{1}{2}$	01$\frac{1}{2}$			
Kimberly Bros	do		07$\frac{19}{100}$	01$\frac{8}{10}$			
R. Searls	do		06$\frac{98}{100}$	01$\frac{48}{100}$			
F. Dusch‡	do		06$\frac{3}{4}$	01$\frac{1}{4}$			
C. R. Robertson	do		07$\frac{7}{8}$	02$\frac{1}{4}$			
S. Westheimer	do		06$\frac{94}{100}$	01$\frac{3}{4}$			
C. Tyler*	do					1 49	
J. Reid & Co	do	03$\frac{3}{4}$				1 75	
C. T. Cabler*	do	03$\frac{5}{8}$					
W. Clarke*	do						\$0 00$\frac{1}{5}$
Do	Hampton Roads						00$\frac{1}{4}$
B. W. Baker	do						00$\frac{1}{4}$
Do	Norfolk, Va						00$\frac{1}{4}$
Benjamin Burr*	Port Royal, S. C		14	03			
James Odell*	do	06$\frac{1}{2}$					
George Dick*	do						01$\frac{1}{2}$
J. Murphy	Pensacola, Fla		08	03$\frac{3}{4}$			
J. S. Bell*	do		07	03			
M. White*	do	07					
J. O'Neal*	do				\$0 06$\frac{1}{2}$		
J. J. Philbrick*	Key West, Fla		11	05			
G. W. Maslin*	do				07		
California Cracker Company*	Mare Island, Cal				03$\frac{49}{100}$		
T. S. Chadbourne	do				03$\frac{3}{4}$		
D. T. Brown*	do	04$\frac{1}{8}$					
J. F. Tobin*	do	04$\frac{1}{2}$	08*	03$\frac{1}{2}$*			
A. Newman & Co	do		08$\frac{1}{2}$	04			
O. H. Keyes	do		09	04			

* Contracts awarded.
† Failed to make contract.
‡ The bid of F. Dusch was withdrawn in favor of J. E. Baum.

Schedule of proposals for beef, pork, beans, and candles received during the fiscal year ending June 30, 1878; the supplies to be delivered at Boston, New York, and Norfolk, during the fiscal year 1877–'78.

Name.	Beef.			Pork.			Beans.			Candles.		
	300 barrels, Boston.	600 barrels, New York.	650 barrels, Norfolk.	500 barrels, Boston.	300 barrels, New York.	850 barrels, Norfolk.	5,000 gallons, Boston.	15,000 gallons, New York.	10,000 gallons, Norfolk.	3,000 pounds, Boston.	5,000 pounds, New York.	10,000 pounds, Norfolk.
	Per bbl.	*Per bbl.*	*Per bbl.*	*Per bbl.*	*Per bbl.*	*Per bbl.*	*Per gall.*	*Per gall.*	*Per gall.*	*Per lb.*	*Per lb.*	*Per lb.*
William Mathews	$18 27	$17 77	$18 77	$14 47	$14 23	$15 23	$0 29 7/10	$0 27 7/10	$0 30 7/10			
A. B. Raymond & Son*							*23¾	*23¼	*24¼			
Manhattan Oil Company*										*$0 17 74/100	*$0 17 49/100	$0 17 99/100
C. E. Wallis							24 55/100	23 95/100	24 95/100	18⅜	18⅜	18 85/100
Armour, Plankinton & Co*	17 75	*17 25	*18 25	14 50	14 00	15 00						
John Harrison*	18 72	18 39		*12 90	*12 90		26	26		19½	19½	
A. Gross & Co										19¼	19	19½
DeWitt Mathews				15 79	14 89							
Cyrus Dupee†	†14 28	†14 12		13 09	12 93							
R. G. Mitchell & Co										18½	18	18½
H. K. & F. B. Thurber & Co*										*17½	17½	*17½
Charles Rohe*	22 30	22 00	22 35	14 30	14 00	*14 35						
William B. Cragin					12 49 ½ bbls. 7 00							
J. W. Roberts & Co	15 29			14 22			26					
Baldwin, Farnum & Shapleigh*	*14 99			14 64			25 79/100					
W. F. Allen & Co									27¾			

*Contracts awarded.

†Failed to make contract.

Schedule of proposals for 30,000 pounds of pickles, received during the fiscal year ending June 30, 1878.

Name.	Where to be delivered.	
	10,000 pounds, New York.	20,000 pounds, Norfolk.
	Per pound.	*Per pound.*
F. A. Waidner & Co.*	\$0 08½	\$0 08½
W. K. Lewis & Bros	09 $\frac{80}{100}$	09 $\frac{80}{100}$
J. W. Jones	13	13
F. Toehrenbuch & Co	09	09
William Underwood †	06 $\frac{88}{100}$	06 $\frac{93}{100}$

* Contract awarded. † Bid informal.

Schedule of proposals for 60,000 pounds of tobacco, received during the fiscal year ending June 30, 1878.

Name.	Where to be delivered.	Price per per pound.
P. Lorillard & Co.*	New York	\$0 47½
P. H. Mayo & Bro	do	47¾

* Contract awarded.

Proposals for eight sets of stationery, received during the fiscal year ending June 30, 1878.

Name.	Where to be delivered.	Total price.
E. M. Whitaker & Son	Washington, D. C	\$811 77
William H. Dempsey *	do	611 40

* Contract awarded.

Statement of contracts made by the Bureau of Provisions and Clothing, for and in behalf of the Navy Department, during the fiscal year ending June 30, 1878.

Name.	Date.	Articles contracted for.	Price.	Where to be delivered.
	1877.			
Dick & Small	July 2	Water .... per gall	$0 01½	Port Royal, S. C.
James Reid & Co	July 3	Baking bread, per bbl. of flour.	1 75	Norfolk, Va.
Benjamin Burr	July 5	Fresh beef .... per lb.	$12\frac{48}{100}$	Port Royal, S. C.
Do	July 5	Vegetables .... do..	03	Do.
James Odell	July 6	Fresh bread .... do..	06	Do.
John Stokell & Co	July 10	Fresh beef .... do..	08	Portsmouth, N. H.
Do	July 10	Vegetables .... do..	01½	Do.
Do	July 10	Fresh bread .... do..	06	Do.
Henry McKenzie	July 11	......do .... do..	06	Pensacola, Fla.
James Murphy	July 11	Fresh beef .... do..	09½	Do.
Do	July 11	Vegetables .... do..	05	Do.
J. O'Neal	July 12	Navy bread .... do..	05½	Do.
J. F. Tobin	July 18	Fresh bread .... do..	04½	Mare Island, Cal.
Do	July 18	Fresh beef .... do..	07	Do.
Do	July 18	Vegetables .... do..	03½	Do.
California Cracker Co	July 19	Navy bread .... do..	$03\frac{8}{10}$	Do.
George W. Maslin	July 30	......do .... do..	06½	Key West, Fla.
John J. Philbrick	July 30	Fresh beef .... do..	11	Do.
Do	July 30	Vegetables .... do..	05	Do.
	1878.			
Hunter, Walton & Co	Jan. 12	Butter, 4,000 pounds ..... do..	42	New York, N. Y.
Do	Jan. 12	Butter, 3,500 pounds ..... do..	43	Norfolk, Va.
F. A. Waidner & Co	Jan. 14	Pickles, 10,000 pounds .... do..	08½	New York, N. Y.
Do	Jan. 14	Pickles, 20,000 pounds .... do..	08½	Norfolk, Va.
S. R. Norris	Jan. 21	Butter, 4,000 pounds, patent packages .... per lb	40	New York, N. Y.
Do	Jan. 21	Butter, 3,500 pounds, patent packages .... per lb	40	Norfolk, Va.
P. Lorillard & Co	Jan. 25	Tobacco, 60,000 pounds ... do..	47½	New York, N. Y.
Armour, Plankinton & Co	Feb. 12	Beef, 650 barrels ...... per bbl.	18 25	Norfolk, Va.
Manhattan Oil Co	Feb. 13	Candles, 5,000 pounds .. per lb.	$17\frac{49}{100}$	New York, N. Y.
H. K. & F. B. Thurber & Co.	Feb. 14	Candles, 3,000 pounds ..... do..	17½	Boston, Mass.
Do	Feb. 14	Candles, 10,000 pounds .... do..	17½	Norfolk, Va.
John Harrison	Feb. 14	Pork, 500 barrels ...... per bbl.	12 90	Boston, Mass.
Do	Feb. 14	Pork, 300 barrels .... do..	12 90	New York, N. Y.
Charles Rohe	Feb. 15	Pork, 850 barrels .... do..	14 35	Norfolk, Va.
A. B. Raymond & Sons	Feb. 23	Beans, 5,000 gallons .. per gall	23¾	Boston, Mass.
Do	Feb. 23	Beans, 15,000 gallons ..... do..	23¼	New York, N. Y.
Do	Feb. 23	Beans, 10,000 gallons ..... do..	24¼	Norfolk, Va.
Armour, Plankinton & Co	Feb. 26	Beef, 600 barrels ...... per bbl	17 25	New York, N. Y.
Baldwin, Farnum & Shapleigh	Feb. 27	Beef, 300 barrels .... do..	14 99	Boston, Mass.
L. J. Tormey	June 14	Fresh beef .... per lb.	07	New York, N. Y.
Do	June 14	Vegetables .... do..	01¼	Do.
J. W. Hobbs	June 14	Fresh beef .... do..	11	Boston, Mass.
Do	June 14	Vegetables .... do..	01⅞	Do.
C. F. Austin & Co	June 14	Fresh bread .... do..	06	Do.
Do	June 14	Baking bread, per bbl. of flour.	1 75	Do.
J. E. Baum	June 14	Fresh beef .... per lb	06½	Norfolk, Va.
Do	June 14	Vegetables .... do..	01½	Do.
James D. Mason	June 15	Baking bread, per bbl. of flour.	1 00	Washington, D. C.
C. T. Goodwin & Sons	June 15	......do .... do..	1 00	New York, N. Y.
William Clark	June 15	Water .... per gall	00⅕	Norfolk, Va.
Do	June 15	......do .... do..	00¼	Hampton Roads.
C. T. Cabler	June 15	Fresh bread .... per lb	03⅝	Norfolk, Va.
Charles Tyler	June 17	Baking bread, per bbl. of flour	1 49	Do.
John McNamara	June 18	Fresh bread .... per lb.	04	New York, N. Y.
L. S. Boraef	June 18	Fresh beef .... do..	09¼	League Island, Pa.
Do	June 18	Vegetables .... do..	03⅕	Do.
Do	June 18	Fresh bread .... do..	$04\frac{7}{10}$	Do.
I. S. Ivins & Son	June 18	Baking bread, per bbl. of flour	1 44	Do.
Cyrus L. Brown	June 18	Fresh bread .... per lb	06	Portsmouth, N. H.
James Odell	June 20	......do .... do..	06½	Port Royal, S. C.
J. T. Varnell	June 21	Fresh beef .... do..	05¼	Washington, D. C.
Do	June 21	Vegetables .... do..	01¾	Do.
B. Charlton	June 21	Fresh bread .... do..	04	Do.
James E. Chase	June 26	Fresh beef .... do..	$06\frac{9}{10}$	Portsmouth, N. H.
Do	June 26	Vegetables .... do..	01	Do.
George Dick	June 27	Water .... per gall	01½	Port Royal, S. C.
Moses White	June 29	Fresh bread .... per lb	07	Pensacola, Fla.
J. O'Neal	June 29	Navy bread .... do..	06½	Do.
Benjamin Burr	June 29	Fresh beef .... do..	14	Port Royal, S. C.
Do	June 29	Vegetables .... do..	03	Do.

NOTE.—Fresh beef and vegetables, bread, and water, to be delivered during the fiscal year in quantities as required.

No. 9.—BUREAU OF STEAM-ENGINEERING.

NAVY DEPARTMENT,
BUREAU OF STEAM-ENGINEERING,
Washington, October 30, 1878.

SIR: I have the honor to submit to the department the annual report and exhibit of the operations of this bureau.

By act of Congress approved March 3, 1877, there was appropriated for this bureau for the fiscal year ending June 30, 1878, $912,000, which amount has been expended as follows, viz:

Labor in navy-yards and stations, in constructing new engines, boilers, and their dependencies; repairing old boilers, machinery, &c., and fitting vessels for sea service; repair, purchase, and preservation of tools; handling and preservation of materials and stores	$532,643 49
Purchase of materials, stores, &c.; freights, and incidental expenses	159,358 46
Completion of new boilers, and completion of erection of the Quinnebaug's machinery, &c	200,602 00
Payments made on foreign stations, for repairs, materials, &c	51,789 08
Total	944,403 03
Less repayment by transfers in adjustment of appropriations	2,458 56
Total actual expenditures	941,944 47
Leaving an unexpended balance of	55 53
Total amount appropriated for 1877–'78	912,000 00

The following tables show the amounts appropriated under "An act making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, eighteen hundred and seventy-eight, and prior years, and for those heretofore treated as permanent, for reappropriations, and for other purposes," the amounts paid from said appropriation, with balances remaining, so far as pertains to the Bureau of Steam-Engineering:

	Appropriated.	Paid.
To American Steam-Gauge Company	$20 50	$20 50
To William H. Arthur & Company	192 30	192 30
To Atlantic Works	1,413 44	1,413 44
To Adams Express Company	2 35	2 35
To Stillman B. Allen	450 00	450 00
To Boston Lead Company	95 00	95 00
To George F. Blake Manufacturing Company	225 00	225 00
To Berner & Pinckney	26 50	26 05
To Cook, Rymes & Company	14 00	14 00
To Coast Wrecking Company	75 00	75 00
To M. A. Campbell	108 60	108 60
To C. H. De Lamater & Company	72,213 07	72,213 07
To Downie, Trainer & Company	69 88	69 88
To F. W. Devoe & Company	122 50	122 50
To Richard Dudgeon	693 86	693 86
To William P. Eddy	4 42	4 42
To Eastern Railroad Company	11 90	11 90
To George E. Hanson	83 00	83 00
To H. H. Ham	3 50	3 50
To Fabri, Chauncey & Company and others, for whom J. D. Hurlburt & Son were ship-brokers	4,031 19	980 60
To John Mullett	25 75	25 75
To A. A. McCullough	271 44	271 44
To Manhattan Packing Company	719 75	719 75
To Neafie & Levy	45,218 64	45,218 64
To Old Dominion Steamship Company	29 92	27 60
To Philadelphia and New York Steam Navigation Company	2 12	....
To Rider & Cotton	106 58	106 58
To Francis Raymond	4 70	4 70
To Sutton & Company	4,745 79	4,745 79
To Thomas M. Shepherd	130 00	130 00

	Appropriated.	Paid.
To Twitchell, Pike & Company	$18 00	$18 00
To E. V. White & Company	152 58	152 58
To E. M. Whittaker & Son	414 59	414 59
To C. C. Wallcott	876 71	....
To George H. Creed	21 75	21 75
To Charles W. Cottle	54 87	54 87
To Mercer Goodrich	1 58	1 58
To Pacific Mail Steamship Company	733 95	733 95
To Pratt & Whitney Company	22,739 93	....
To M. A. & C. A. Santos	29 75	29 75
To Vickery & Company	109 30	109 30
To Harlan & Hollingsworth Company	84,136 39	61,254 71
To T. F. Rowland	47,428 25	47,428 25
To Quintard Iron Works	116,384 20	116,082 54
To Quintard Iron Works (paid to Ashcroft)	5,000 00	5,000 00
To Quintard Iron Works (paid to Murphy & Co.)	301 66	301 66
To William Cramp & Sons	66,850 00	44,000 00
To C. F. Hatch	54 50	54 50
To American Tube Works	7,059 75	2,239 18
To E. H. Ashcroft	625 00	625 00
To A. P. Brown	51,846 38	51,846 38
To D. Babcock & Company	6,464 93	6,464 93
To Chalmers, Spence & Company	1,243 73	1,243 73
To G. P. Goff	8,265 40	8,265 40
To A. M. Ingersoll	13,156 50	13,156 50
To Manhattan Oil Company	16,883 56	16,883 56
To W. A. Torrey & Company	36,521 72	36,521 72
To Walton Brothers	8,694 63	8,694 63
To James M. Motley	4,320 00	4,320 00
To Providence Steam-Engine Company	288,187 22	267,861 87
To John Roach	323,139 50	236,073 37
To South Boston Iron Company	181,049 64	181,049 64
Total	1,423,876 67	1,238,959 16

There yet remain to be paid from the above appropriation, for work not yet completed, or accounts not yet settled, the following sums, viz:

To Fabri & Chauncey and others, for whom J. D. Hurlburt & Son were ship-brokers	$3,050 59
To C. C. Walcott	876 71
To Pratt & Whitney Company	22,739 93
To Harlan & Hollingsworth Company	22,881 68
To W. Cramp & Sons	22,850 00
To John Roach	87,066 13
Total to be paid	159,465 04

The following amounts were appropriated in excess of what was found upon final settlement of accounts to be due the parties named:

Benner & Pinckney	$0 45
Old Dominion Steamship Company	2 32
Philadelphia and New York Steam Navigation Company	2 12
Quintard Iron Works	301 66
American Tube Works	4,820 57
Providence Steam Engine Company	20,325 35
Total unexpended balance to be reappropriated or turned into the Treasury	25,452 47

The above exhibit shows the bureau entirely free of debt, with a small unexpended balance of appropriation 1877–'78, and a surplus on account of appropriation for deficiency, of $25,452.47.

NAVY-YARDS.

The departments under cognizance of this bureau at the several yards, under their present organization and equipment, are in excellent working condition.

Your attention is respectfully called to my reports of November and

December, 1877, in relation to certain additional buildings and equipments required at the navy-yards at Norfolk and Pensacola.

In view of the unsettled state of affairs on the Mexican border, it becomes a matter of the first importance to have the Pensacola navy-yard placed in the highest state of efficiency; the tools required to equip the proposed additions to the shop could be supplied to some extent from the other yards without affecting their present efficiency.

BOILER CONTRACTS.

With the exception of the contracts for boilers for the iron-clads Puritan, Amphitrite, and Terror, all contracts for boilers made under the last administration have been completed, the work inspected and received, and the boilers and appendages, except those which have been utilized in fitting vessels for sea-service, have been carefully stored in our navy-yards for future use.

The following will exhibit the extent and character of the work done, under the cognizance of this bureau, since my last report, upon the boilers and machinery of naval steamers, together with their present condition, and the time required to fully complete and fit for sea:

Alaska (2d rate).—New boilers have been erected on board, a new composition four-bladed propeller of bureau design fitted in place of the former two-bladed one, engines and dependencies put in thorough repair. Ship in commission. When ready for sea in all respects, a maximum speed trial under steam alone was made, with a restricted steam pressure, the results of which were most satisfactory as compared with previous performances of the ship, a speed of over eleven knots having been maintained without difficulty.

Powhatan (2d rate).—New boilers have been placed on board and the machinery put in thorough condition for protracted service. The four new boilers used on this ship were removed from the iron-clad Colossus, the hull of which ship has been condemned. The two boilers remaining have been stored with a view to future use.

Pensacola (2d rate).—This vessel has been supplied with new boilers, machinery, and dependencies placed in complete repair. A new four-bladed propeller, of bureau design, has been cast and will be fitted at the first favorable opportunity.

Ticonderoga (2d rate).—Engines, boilers, and dependencies thoroughly repaired and fitted for sea. The two-bladed propeller removed, and the original four-bladed one restored.

Richmond (2d rate).—Fitted with new boilers and a new four-bladed propeller. Engines and dependencies put in thorough repair. In commission.

Quinnebaug (3d rate).—Engines, boilers, and dependencies completed for sea. Now in commission.

Tuscarora (3d rate).—Engines, boilers, and attachments thoroughly overhauled and repaired. Ship in commission.

Lackawana (2d rate).—Extensive repairs, including new boilers. In commission.

Kearsage (3d rate).—New boilers and extensive repairs to machinery. Can be prepared for sea in forty days.

Shenandoah (2d rate).—New boilers. Machinery extensively repaired and put in good condition. New four-bladed propeller. Can be prepared for sea in seventy days.

Wachusett (3d rate).—Extensive overhauling and repairs to engines, &c. New boilers. Ready for sea in twenty days.

Wyoming (3d rate).—Slight repairs to machinery and boilers. In commission.

Brooklyn (2d rate).—Extensive repairs, including new boilers and a new four-bladed propeller. Can be prepared for sea in ninety days with full force.

Canandaigua (2d rate).—Extensive repairs to engines and boilers. Fitted with a new four-bladed propeller.

Monongahela (2d rate).—Extensive repairs to engines and boilers. Vessel in commission.

Enterprise (3d rate).—Outfit completed and vessel in commission.

Tallapoosa (4th rate).—Repairs to machinery and boilers. New paddle-wheels.

Gettysburg (4th rate).—Repairs made abroad.

Nipsic (3d rate).—Erecting engines. A new four-bladed propeller of bureau design has been cast and fitted, and is stored ready for use.

Catalpa (tug).—General overhauling and repairs.

Leyden (tug).—Thorough repairs to machinery. New boilers.

Mayflower (tug).—Extensive repairs to engines and boilers.

Speedwell (tug).—General repairs.

Rose (tug).—Thorough overhauling of engines, boilers, and dependencies.

Standish (tug).—New boilers. Machinery repaired.

Triana (tug).—General repairs.

SPECIAL WORK.

At the various navy-yards the following work has been done during the past year, in addition to the routine labor of fitting and repairing machinery, boilers, &c., on board naval vessels.

New engines of the compound type, from bureau designs, are in a forward state of readiness for the Mohican and Galena, and will be ready for service by the time these vessels are prepared to receive them.

Boilers, designed by the bureau, of the description required for use in connection with the compound type of engines, are in process of construction for the Nipsic and Galena.

Steam-launch engines and boilers to the number of 37 boilers and 23 engines have also been built and erected during the past year, and a large proportion of them are now in service with the various naval vessels in commission, the remainder being stored at the several navy-yards for expenditure as they may be required.

Ten large screw propellers (composition), aggregating a finished weight of 62 tons, of bureau design, have been cast at the Washington yard, mostly from old and condemned propellers and scrap collected from the various yards.

There is in course of gradual construction at the same yard a rolling-mill of medium size, and its motive engines, for the Mare Island navy-yard. The very satisfactory results obtained from the use of the one recently built, and now in operation at the Washington navy-yard, leaves no doubt as to the great saving in annual outlay for bar-iron for naval purposes.

WORK REQUIRED.

The following will show the character and extent of the work necessary to be carried out on the vessels enumerated during the fiscal year 1879–'80, under the cognizance of this bureau.

Ashuelot.—General overhauling and repairs.

Brooklyn.—Under repair at New York.
Canandaigua.—Under repair at Norfolk, Va.
Colorado.—Small repairs, &c.
Hartford.—Needs thorough repair and new boilers.
Galena.—Completion of new engines and boilers.
Iroquois.—Extensive repairs and new boilers.
Juniata.—Completion of the repairs in progress; new boilers already completed to be placed in ship.
Lancaster.—Complete overhauling, if rebuilt for flagship.
Michigan.—General repairs and new boilers.
Mohican.—Continue work already in progress.
Monocacy.—General overhauling and repair.
Monongahela.—Sundry repairs, to maintain present condition.
Narragansett.—Thorough repair and new boilers.
New York.—Adapt engines and new boilers (non-compound), now on hand.
Omaha.—Extensive repairs, and new boilers already completed, to be placed in ship.
Ossipee.—Extensive repairs and new boilers.
Swatara.—General repairs.
Standish.—New boilers, already completed, to be placed in the ship.
Tuscarora.—Extensive repairs and new boilers.
Yantic.—New boilers, already completed, to be placed in the ship.

EXPERIMENTAL INVESTIGATIONS.

The board of experienced engineer officers convened at the navy-yard, New York, of which Chief-Engineer B. F. Isherwood, U. S. N., is president, is busily engaged in examining and reporting upon subjects submitted to them by the department.

The board is performing noteworthy service, and its researches and reports are alike valuable to the naval service and to the general public. The work now being done consists of experiments with coal of different varieties, furnished without expense to the government from various mines; the determination of the value of various liquid fuels and subjects connected therewith.

In addition to this experimental duty, the board is required to conduct the dock and speed trials of naval vessels fitting for sea.

BOILER PLATE.

By a joint resolution, approved June 14, 1878, the department is authorized to purchase at the lowest market price such plate-iron, &c., as may enter into the construction of steam-boilers for the Navy without advertising for bids to furnish the same. This plate-iron, by the terms of the law, must be tested publicly, and inspected by competent authority, before being purchased.

To comply with the law, and to insure the procurement of the best material in the market, it is respectfully recommended that a special appropriation be asked for of $3,500, to enable this bureau to purchase a testing machine for plate-iron, having a capacity of not less than 150,000 pounds. Such a machine, erected at the navy-yard here, will be of great value, not only for the purposes contemplated by the above-mentioned law, but for current use in the several departments of the yard.

SALE OF OLD MATERIAL.

It is respectfully recommended that existing laws in relation to the sale of old and condemned material be so far amended that the proceeds of such sales, under the cognizance of this bureau, may be directly applied to the purchase of new material, tools, stores, &c., instead of, as at present, turning these proceeds into the Treasury, where they cease to be available for bureau use. In this connection, I respectfully renew my request in last year's report, that the law in relation to the proceeds of public sales be so amended as to allow the expenses of such sales, advertising, auction fees, &c., to be deducted from the proceeds of the sale.

Under existing law, section 3618 of the Revised Statutes, these expenses are a charge upon the regular appropriation, and so become a source of loss to the bureau to that extent.

NAVAL ARCHITECTURE.

In the annual report of this bureau of November 9, 1877, I submitted for your consideration the recommendation that the periods devoted to the subject of naval architecture at the Naval Academy (as applicable exclusively to the theory and practice of iron ship building) might be extended; *i. e.*, that more time be devoted to this particular branch of marine engineering. I learn that this recommendation has been carried out.

I now very respectfully call your attention to the law providing for the appointment of engineer graduates from the Naval Academy as assistant naval constructors (section 1403 of the Revised Statutes), and to state that the academic board have recommended two or three of the engineer graduates for the appointment of assistant naval constructors, and their applications are now on file. The high order of merit attained in all of their studies at the Academy, and especially their distinguished mathematical acquirements, fit them in an especial manner for the discharge of the duties of naval constructors as they should be, and probably will be, conducted in the future.

As a measure of economy for the government, I wish to point to the fact that these officers, while under instruction in practical steam-engineering and naval architecture at the Academy, and during their annual visits to the various iron ship-building establishments for practical information during the summer cruising, and by the experience gained on foreign stations, become better fitted in all that relates to the requirements of an iron ship—her strength, adaptability to the end proposed, &c.—than any appointee from civil life can be. In addition to which, they become more thoroughly imbued with that *esprit de corps* so essential to harmony and success in a military organization.

PERSONNEL OF THE ENGINEER CORPS.

The number of vacancies is still quite large, causing frequent embarrassment to the bureau in the assignment to duty of engineer officers in the lower grade; but under the operation of existing law, and by reason of the high standard of qualification for entry at the Naval Academy, insuring a large percentage of graduates annually, these vacancies will be gradually filled from this source alone.

PENSIONS FOR DISABLED MECHANICS.

Government, very properly and most justly, pensions its sailors and soldiers, provides the comforts of homes and asylums for them in their

declining years, and in case of death in the line of duty cares for the widow and the orphan. There is yet another class of public servants in whose behalf I would make an earnest appeal, the mechanics employed in our navy-yards and stations. For them there is no provision in case of death or disability in the discharge of their duties. It matters not how long or how faithfully they may have served the government, nor how hazardous their duty or calling; an arm or a leg is broken, an eye is lost, a hand is crushed, or, perhaps, instant death overtakes the laborer, and he is borne to his home by his fellow-workmen; he fails to answer at the next roll-call, his name is first checked, then stricken from it altogether; a few dollars is, perhaps, collected by subscription among his fellow-laborers, and that is the last of him and his family, so far as the government is concerned.

Another class there is who, after long and faithful service in government employ, become enfeebled by age or the infirmities incident to their calling, find themselves no longer able to fill the inexorable demand for a full day's work, and so must be discharged altogether or reduced to a lower grade of pay, perhaps scarcely sufficient to supply the commonest necessities of life. Upon this subject I am able to speak advisedly, as accidents and disabilities such as I have above referred to come under my personal observation in the departments under cognizance of this bureau.

I therefore respectfully recommend that such provision be made as in the wisdom of Congress may seem to be advisable to meet the necessities of the class of public servants whose perils and wants I have thus briefly summarized; and as our navy-yards and stations are open to the workmen from all parts of the United States alike, no distinction or preferment being shown save as to merit, so the benefits of any action by Congress, as recommended, will not be confined to citizens from any particular section.

ESTIMATES.

I have the honor to submit herewith the annual estimates of this bureau for the fiscal year ending June 30, 1880.

It is proper to state that these estimates have been carefully examined and revised, and I am of the opinion that the amounts are the lowest practicable for carrying on the operations of this bureau for the said fiscal year.

I have the honor to be, very respectfully, your obedient servant,

W. H. SHOCK,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Bureau of Steam Engineering, Navy Department.

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.			
Chief clerk, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		$1,800 00	
Draughtsman, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		1,800 00	
Assistant draughtsman, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		1,600 00	
One clerk of class two, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		1,400 00	
One clerk of class one, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		1,200 00	
One clerk, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		1,000 00	
One assistant messenger, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		720 00	
One laborer, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		660 00	
		10,180 00	$10,180 00
CONTINGENT.			
For stationery and miscellaneous items, per act June 19, 1878 (Stat. at L., p. 198, ch. 329)		700 00	700 00
STEAM MACHINERY.			
For preservation of machinery, boilers, &c., in vessels on the stocks and in ordinary; purchase and preservation of all materials and stores; purchase, fitting, and repair of machinery and tools in the navy-yards and stations; wear, tear, and repair of machinery, boilers, &c., of naval vessels; incidental expenses, such as foreign postages, telegrams, advertising, freight, &c., appropriated per act May 4, 1878 (Stat. at L., p. 54, sec. 91)		1,497,000 00	800,000 00
CIVIL ESTABLISHMENT.			
Portsmouth, N. H., navy-yard:			
One clerk	$1,300 00		
One writer (store)	1,017 25		
		2,317 25	....
Boston, Mass., navy-yard:			
One clerk	1,300 00		
One writer (store)	1,017 25		
		2,317 25	....
Brooklyn, N. Y., navy-yard:			
One clerk	1,400 00		
One clerk	1,300 00		
One writer (store)	1,017 25		
		3,717 25	....
League Island, Pa., navy-yard:			
One clerk	1,300 00		
One writer (store)	1,017 25		
		2,317 25	....
Washington, D. C., navy-yard:			
One clerk	1,300 00		
One writer (store)	1,017 25		
One writer	1,017 25		
		3,334 50	....
Norfolk, Va., navy-yard:			
One clerk	1,300 00		
One writer (store)	1,017 25		
		2,317 25	....
Pensacola, Fla., navy-yard:			
One writer		1,017 25	....
Mare Island, Cal., navy-yard:			
One clerk	$1,400 00		
One clerk	1,300 00		
		2,700 00	....
		20,038 00	....

No. 10.—BUREAU OF CONSTRUCTION AND REPAIR.

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR,
October 30, 1878.

SIR: I have the honor to submit, in conformity with your instructions of the 22d instant, statements of the work of this bureau for the past year, and estimates covering expenditures required for the fiscal year ending June 30, 1880.

1877.			
July 1. Amount appropriated by Congress for the fiscal year 1877–'78			$1,750,000 00
Expended from July 1, 1877, to June 30, 1878, for materials, &c		$328,528 27	
Expended from July 1, 1877, to June 30, 1878, for labor at navy-yards		1,383,608 00	
			1,712,136 27
Balance on hand July 1, 1878			37,863 73
1878.			
April 30. Amount appropriated by Congress to pay mechanics for labor performed during the fiscal year 1876–'77			25,993 41
Expended during May, 1878			25,993 41
		For timber.	For sundries.
June 14. Amount appropriated by Congress to meet a deficiency on account of fiscal year 1876–'77		$416,319 32	$931,134 55
Expended from June 15 to June 30, 1878		261,801 09	673,885 86
Balance on hand July 1, 1878		154,518 23	257,248 69

Vessels on which work in repairing or completion was done during the fiscal year 1877–'78.

Antietam.	Iroquois.	Pinta.
Alaska.	Jason.	Portsmouth.
Ajax.	Jean Sands.	Powhatan.
Camanche.	Juniata.	Plymouth.
Canandaigua.	Kearsarge.	Quinnebaug.
Canonicus.	Lackawanna.	Rescue.
Catskill.	Lancaster.	Richmond.
Cohasset.	Lehigh.	Saratoga.
Colorado.	Leyden.	Saugus.
Constellation.	Mahopac.	Shenandoah.
Constitution.	Manhattan.	Snowdrop.
Despatch.	Mayflower.	Sorrell.
Emerald.	Miantonomoh.	Speedwell.
Enterprise.	Minnesota.	St. Louis.
Essex.	Monadnock.	Supply.
Fortune.	Monongahela.	Swatara.
Franklin.	Montauk.	Tallapoosa.
Frolic.	Monterey.	Ticonderoga.
Galena.	Nahant.	Trenton.
Glance.	New Hampshire.	Triana.
Guard.	Nipsic.	Tuscarora.
Hartford.	Ossipee.	Wabash.
Huron.	Passaic.	Wachusett.
Independence.	Pensacola.	Wyandotte.
Intrepid.	Pilgrim.	Wyoming.

The labor of the bureau for the past year, and in the absence of an appropriation to build new ships, has been chiefly in the direction of keeping in good repair those which we now have, and the money appropriated has been expended accordingly. As it has been desirable to reduce rather than increase our stock of material, the expenditures have been chiefly for labor.

While many of the vessels mentioned in the foregoing statement have required and received only such repairs as were necessary to keep them

in good condition, others have been very thoroughly overhauled, and are now in condition for good service for years to come; these are the Alaska, Ticonderoga, Kearsarge, Richmond, Shenandoah, Lackawanna, Pensacola, Powhatan, and Saratoga. The Quinnebaug has been completed and is now in commission. The Nipsic has been launched and is now being fitted for sea; and the Galena will be ready for launching early in December next.

In repairing the Richmond, the system of ventilation recommended by a board of officers consisting of Medical Inspector T. J. Turner, Commander J. R. Bartlett, Chief Engineer David Smith, and Naval Constructor F. L. Fernald has been adopted. Good results are anticipated, but experience alone can determine whether the system is a good one.

Fourteen monitors and two large torpedo-boats are in good condition and ready for service. One of the large monitors now building (the Miantonomoh) can be completed with the funds already in hand; the others, viz, Monadnock, Terror, Amphitrite, and Puritan, cannot be finished without an additional appropriation in this bureau of $1,895,614.

We are prepared to build and fit out ships in all of our yards except Pensacola and League Island. In the former yard we await only the completion of the floating-dock to enable us to repair all naval vessels cruising in or near the Gulf of Mexico. In the latter yard the necessity of a dry-dock becomes more and more apparent. For want of such a dock we cannot complete vessels in all respects ready for sea, and we are therefore subjected to the expense of doing the work at two places.

Besides the usual work required on vessels to keep them in good order, we are now thoroughly repairing the Lancaster, Wachusett, Tennessee, Juniata, Yantic, and Iroquois. The repairs on these ships will be completed as rapidly as the funds of the bureau will allow.

The service requires fast, unarmored cruising ships, and also one or more powerful rams. The cruising ships are not only wanted to replace some of those now in commission, and which, for lack of speed, are not suited to the wants of the service, but would be absolutely necessary for us in case of war with any maritime power.

With very fast ships we can destroy the commerce of an enemy, and be on equal terms with his ships of like character; while in the event of meeting with powerful but comparatively slow armored ships, we could leave them at pleasure. Believing that Congress would not long delay the appropriations needed for vessels of this character, directions have been given to have plans prepared, by naval constructors having work in charge, for iron unarmored cruising vessels of 3,500 tons displacement, and iron rams of 2,000 tons displacement. These plans will, it is thought, combine all the improvements in ship-building for the last few years.

The estimate of $1,500,000 for the fiscal year ending June 30, 1880, will be required in keeping in good order ships needing but slight repairs, and in completing or extensively repairing the following-named vessels, viz, Mohican, Brooklyn, Ossipee, Hartford, Canandaigua, Monocacy, Lancaster, and Ashuelot.

I would again suggest the propriety of ridding our yards of ships not worth repairing or completing, but which are a constant source of expense, either by selling them at auction or breaking them up; in either case, the proceeds to be turned over to the department for use in repairing or building other vessels.

All of which is respectfully submitted.

J. W. EASBY,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Bureau of Construction and Repair.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.		
Chief clerk, per act of June 19, 1878 (pamph. ed., p. 197)	$1,800 00	
Draughtsman, per act of June 19, 1878 (pamph. ed., p. 197)	1,800 00	
One clerk of class four, per act of June 19, 1878 (pamph. ed., p. 197)	1,800 00	
One clerk of class three, per act of June 19, 1878 (pamph. ed., p. 197)	1,600 00	
One clerk of class two, per act of June 19, 1878 (pamph. ed., p. 197)	1,400 00	
One clerk of class one, per act of June 19, 1878 (pamph. ed., p. 197)	1,200 00	
One assistant messenger, per act of June 19, 1878 (pamph. ed., p. 197)	720 00	
One laborer, per act of June 19, 1878 (pamph. ed., p. 197)	660 00	
	10,980 00	10,980 00
CONTINGENT.		
Stationery and miscellaneous items; appropriated (pamph. ed. p. 197)	400 00	400 00
CONSTRUCTION AND REPAIR OF VESSELS.		
Preservation of vessels on the stocks and in ordinary; purchase of materials and stores of all kinds; labor in navy-yards and on foreign stations; preservation of materials; purchase of tools; wear, tear, and repair of vessels afloat, and for general care and protection of the Navy in the line of construction and repair; incidental expenses, namely, advertising and foreign postage; appropriated (pamph. ed., p. 53)	1,500,000 00	1,500,000 00
CIVIL ESTABLISHMENT.		
At the navy-yard, Kittery, Me.:		
One clerk to naval constructor	1,400 00	
One clerk of store-houses	1,300 00	
One writer	1,017 25	
Two writers	1,878 00	
	5,595 25	
At the navy-yard, Boston, Mass.:		
One clerk to naval constructor	1,400 00	
One clerk of store-houses	1,300 00	
One writer	1,017 25	
Two writers	1,878 00	
	5,595 25	
At the navy-yard, Brooklyn, N. Y.:		
One clerk to naval constructor	1,400 00	
One clerk of store-houses	1,300 00	
One writer	1,017 25	
Two writers	1,878 00	
	5,595 25	
At the navy-yard, League Island, Pa.:		
One clerk to naval constructor	1,400 00	
One clerk of store-houses	1,300 00	
One writer	1,017 25	
Two writers	1,878 00	
	5,595 25	
At the navy-yard, Washington, D. C.:		
One clerk to naval constructor	1,400 00	
One clerk of store-houses	1,300 00	
One writer	1,017 25	
Two writers	1,878 00	
	5,595 25	
At the navy-yard, Norfolk, Va.:		
One clerk to naval constructor	1,400 00	
One clerk of store-houses	1,300 00	
One writer	1,017 25	
Two writers	1,878 00	
	5,595 25	

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
CIVIL ESTABLISHMENT—Continued.		
At the navy-yard, Pensacola, Fla.:		
One writer	$939 00	....
At the navy-yard, Mare Island, Cal.:		
One clerk to naval constructor	1,400 00	....
One clerk of store-houses	1,300 00	....
One writer	1,017 25	....
Two writers	1,878 00	....
	5,595 25	....

No. 11.—MARINE CORPS.

HEADQUARTERS MARINE CORPS,
COMMANDANT'S OFFICE,
Washington, D. C., October 1, 1878.

SIR: I have the honor to submit my annual report for the past year.

At the present time there are 1,942 enlisted men in the Marine Corps, of whom 1,053 are on board ships in commission, and 889 at the several shore stations.

INCREASE OF ENLISTED MEN.

I renew my recommendation of last year that the Navy Department should favorably consider the additional estimates submitted for 300 more privates. The number allowed (1,500) is so small that it is impossible to supply the demands of the Navy and properly perform the duty required. This leaves the Naval stations without adequate protection, and the vessels of the Navy without proper guards.

BARRACKS AND QUARTERS.

The subject of barracks for enlisted men and quarters for officers is one which urgently calls for immediate attention.

At League Island the men are quartered on board an iron-clad (the Dictator), living below water, in dampness, with insufficient light, and during the heat of the past summer under an iron deck. These are the best barracks that I have been able to procure for them. The officers, having no quarters, are forced to live five miles away in Philadelphia.

At Annapolis the men are quartered in a shed built on a wharf, and mess on board an old ferry-boat, past repair, which it is impossible to keep dry. Here, also, are quartered the officer of the day and guard for the day. There are no quarters for officers, who have to live away from the men in Annapolis.

At Norfolk the barracks are only a small frame building of one story, built in the most unhealthy and unsuitable place in the navy-yard, with a swamp a few feet in front of it, and a high brick wall immediately in the rear, cutting off all supply of air.

There are no quarters for officers, who live in Norfolk.

At the navy-yard at Washington, D. C., the barracks are much too small for the command, and should be enlarged. There are no quarters for officers, who live in the city at long distances from the men.

It is respectfully submitted that such a state of things is not calculated to promote content or discipline.

As the government has paid annually a large sum as "commutation of quarters" for officers for many years, it would have been economy to have built quarters long since, which could have been done at a reasonable expense. The barracks at Brooklyn, N. Y., and Mare Island, Cal., which are the largest we have, are much out of repair, and a special appropriation for them and for alterations at the navy-yard, Washington, D. C., is greatly needed. Estimates are submitted amounting to $21,955.85 for this purpose. Those of last year for the building of barracks at League Island and Annapolis, and for officers' quarters at these posts and Norfolk, are again submitted, and it is urgently requested that the department will favorably recommend that these estimates be inserted in the naval appropriation bill for 1880–'81.

COMMISSIONED OFFICERS.

The number of second lieutenants is now reduced to 20, leaving 9 more vacancies to occur before any appointments can be made, in compliance with the naval appropriation bill of 1876–'77.

I respectfully recommend the passage of an act requiring the examination of officers before promotion, in the same manner as in the Navy, and that when appointments are again made in the grade of second lieutenant they be graduates of the Military Academy, with a due proportion of worthy non-commissioned officers to be examined and promoted in the same manner as is provided by a recent act for the Army.

I also recommend that the "fleet officer" of marines shall have the rank and pay of the next higher grade while so serving.

BAND.

I renew my recommendation of last year that the band of the Marine Corps, being properly a national band (as it is used for all official purposes in Washington, and sometimes elsewhere), should in justice to the worthy men who have, many of them, served faithfully for long periods, be put upon a proper footing by Congress as regards classes and pay.

I have already submitted to the department the draught of a bill for this purpose.

GUARD AT THE PARIS EXPOSITION.

A detachment of the corps, consisting of 2 officers and 29 enlisted men, has been serving at the Paris Exposition since its opening, as a protection for the American goods exhibited there. Their appearance, discipline, and efficiency have elicited much praise from both Europeans and Americans, and they have been compared favorably with troops of other nations so employed.

DISCIPLINE AND EFFICIENCY.

Every effort has been made on my part, during the past year, to bring the corps up to the highest state of discipline and efficiency, and in proficiency in all military exercises. The inspections show that a marked

improvement is visible in this respect. The instruction of officers and men is more careful than it has ever been before, and with excellent results.

I have the honor to be, very respectfully, your obedient servant,

C. G. McCAWLEY,
Colonel Commandant.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

HEADQUARTERS MARINE CORPS,
COMMANDANT'S OFFICE,
Washington, D. C., October 30, 1878.

SIR: The inclosed copies of reports upon the condition of the marine barracks at Norfolk, Va., I beg may be placed, in connection with my annual report, before the Committee on Appropriations of the House of Representatives, should the department think proper.

Very respectfully, your obedient servant,

C. G. McCAWLEY,
Colonel Commandant.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

MEDICAL OFFICE, NAVY-YARD,
Norfolk, Va., October 9, 1878.

SIR: In submitting the following paper, relating to the marine command and marine barrack of this station, I would respectfully state that it would have been forwarded to your office at an earlier date had not yellow fever been prevailing to an alarming extent in the Southern States, on which account it was purposely delayed to prevent any unnecessary alarm on the part of those connected with the navy-yard, of whom many were fully impressed with the belief that the scourge had already reached Norfolk.

The complement of the marine command, non-commissioned officers and privates, is about 100; of this number I find that fully one-fifth, a daily average and a very large percentage, is incapable of performing duty by reason, in the majority of instances, of malarial fever contracted while on post, but more particularly during sleeping hours in the barrack.

The cases readily yield to treatment, but frequent attacks soon enervate and dishearten the most robust and best disposed patient, who is then hurried off to the hospital, to remain for weeks or months; when restored to proper condition he is returned to the navy-yard, where, if in summer or autumn, he is again exposed to, accepts, and manifests the effects of a fresh dose of malarial poison; in the mean time the inefficiency of the marine guard is shown daily by diminishing numbers.

The marine barrack is at the farther end of the navy-yard, in an unhealthy and undesirable location. The ground is made and being made; the river frequently overflows its spongy bank; the porous earth rapidly absorbs the rain only to give it back heavily charged with miasm. Near here the main sewer empties into the river; decaying timber and water-soaked piling assist in contaminating the atmosphere, while the

western wall of the yard materially interferes with the proper ventilation of the barrack.

The barrack is a one-story wooden structure, resting on brick piers two feet above the ground, is 131 feet long by 35 feet wide, divided longitudinally by a partition, on one side of which are the dining-room, kitchen, two store-rooms, and three offices; on the other is the sleeping apartment running the whole length of the building, and of which the dimensions are 130 by 20 feet; height, 16 feet.

As the accommodations are for 100 men, it will be seen by the measurements of the sleeping apartment that to each man is allotted only 416 cubic feet of air-space, when he should have, as found by experience, at least 500, with frequent renewals of wholesome air; this difference, however, would not materially affect the health of the sleepers in summer and autumn in a healthy location; but here, with all the windows and doors open, the exhaled poisonous carbonic-acid gas is not replaced or adulterated by healthy and vitalizing atmospheric air, but simply substituted for miasmatic effluvia, and the consequences are a large sick-list and an inefficient guard.

In concluding this paper, which partakes more of a simple statement of existing facts than of a report, you will please observe I have made no comments or suggestions, preferring to wait until the commanding officer of the Marines addresses you officially on the state of his command and the condition of the barrack.

Very respectfully, &c.,

M. BRADLEY,
Surgeon, U. S. N.

Commodore J. BLAKELEY CREIGHTON, U. S. N.,
Commandant Navy-Yard, Norfolk, Va.

MARINE BARRACKS,
Norfolk, Va., October 12, 1878.

SIR: I have the honor to make the following report regarding the building now in use as a barracks for the Marines of this station. The building is a frame one, and when built was considered merely as a temporary affair; it is a single story, raised on brick pillars about three feet from the ground, and is open to the easterly winds only, as it stands close to the navy-yard wall, which completely cuts off any breeze or ventilation from any point from north to south by the west. The ground is "made land," and the "rotting timber," "marsh mud," exposed to tidal influences have caused a diminution in the strength of this command to such an extent as to render it almost impossible to keep up the regular guard routine. I have found that the sick report of this command will average about 25 per cent. of its strength, caused almost entirely by miasmatic influences and bad ventilation. The building is not large enough for the command, and I would strongly urge that such steps be taken as will assure the erection of a suitable building in a more healthy part of the yard. During the recent visit of the honorable Secretary of the Navy, he inspected these barracks and seemed fully impressed as to their unsuitability, they at that time being so crowded as to hardly allow a narrow passageway between the bunks. The sick have to be sent to the general hospital; whereas, was there a building properly erected in a more healthy section of the yard, I am confident that the health of the command would be materially improved, and the command rendered efficient and available for any and all duty.

I sincerely trust that you may feel assured of the great importance

of an immediate change in the location of, and building of, a proper barracks.

I have the honor to be, very respectfully, your obedient servant,

F. H. HARRINGTON,
First Lieutenant, United States Marine Corps, Commanding Post.

Commodore J. BLAKELEY CREIGHTON, U. S. N.,
Commandant Norfolk Navy-Yard, Norfolk, Va.

HEADQUARTERS MARINE CORPS,
COMMANDANT'S OFFICE,
Washington, D. C., September 25, 1878.

SIR: I respectfully forward to the department, in duplicate, "Estimates of appropriations for the Paymaster's and Quartermaster's Departments, United States Marine Corps," for the fiscal year ending 30th June, 1881.

I also inclose letters from the paymaster and quartermaster in relation to the estimates.

I have the honor to be, your obedient servant,

C. G. McCAWLEY,
Colonel Commandant.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

UNITED STATES MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September 25, 1878.

SIR: I respectfully transmit herewith the annual estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Quartermaster's Department of the Marine Corps.

These estimates vary from those of fiscal year ending June 30, 1879, as follows:

Provisions, decreased	$7,227 00
Clothing, decreased	1,866 00
Fuel, decreased	4,867 50
Transportation, &c	400 00
Military stores, decreased	313 50
Repair of barracks, increased	2,000 00
Forage, decreased	4,500 00
Contingencies, decreased	5,000 00

The aggregate amount of these estimates is $38,174 less than that asked in estimates of last year.

Under military stores, the amount required to pay mechanics is estimated for separately, and by direction of the honorable Secretary of the Navy the purchase of arms and ordnance stores heretofore obtained from the Army is also estimated for.

New instruments being required for the band, the sum of $1,400 is estimated as their cost.

The aggregate amount appropriated for the Quartermaster's Department for fiscal year ending June 30, 1879, was $214,000. The aggregate amount asked for fiscal year ending June 30, 1880, is $213,981.50, being $18.50 less than the amount appropriated for current fiscal year.

I am, very respectfully, your obedient servant,

W. B. SLACK,
Quartermaster, Marine Corps.

Col. CHAS. G. McCAWLEY,
Commandant United States Marine Corps, Headquarters.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Quartermaster's Department United States Marine Corps.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1879.
PROVISIONS.			
1,000 non-commissioned officers, musicians, privates, and washerwomen, 365 days, at one ration per day, is 365,000 rations, at 20 cents per ration	$73,000 00		
Difference between the cost of rations at 20 cents and commutation at 75 cents, for ten enlisted men, employed as clerks, messengers, laborers, and orderly in commandant's, adjutant's, and inspector's, quartermaster's and assistant quartermaster's offices, for 365 days, being 3,650 rations, at 55 cents per ration, is	2,007 50	$75,007 50	$78,000 00
CLOTHING.			
2,000 non-commissioned officers, musicians, and privates, at $32.25 per annum, actual cost per contracts 1878–'79	64,500 00		
400 overcoats, at $8.11 each	3,244 00	67,744 00	60,000 00
FUEL.			
3,894 cords of wood, as follows: one colonel commandant, one colonel, two lieutenant colonels, four majors, three staff-majors, two staff-captains, twelve captains, fifteen first lieutenants, fifteen second lieutenants, one thousand non-commissioned officers, musicians, privates, and washerwomen; six hospitals, one armory, five mess-rooms for officers, sixteen offices for commandant and staff and commanding officers of posts, nine rooms for officers of the day, nine guard-rooms at barracks and navy-yards, three stores for clothing and other supplies; one-fourth additional on 2,400 cords, quantity supposed to be required in latitude north 36 degrees, from September 1 to April 30, 600 cords, amounting in all to 3,894 cords, at $5.25 per cord		20,443 50	20,000 00
MILITARY STORES.			
Pay of one chief armorer, at $3 per day, $939; three mechanics, at $2.50 per day each, $2,347.50; in all	3,286 50		
Purchase of military equipments, such as cartridge-boxes, bayonet-scabbards, haversacks, canteens, musket-slings, swords, arms and ordnance stores, drums, fifes, bugles, flags, &c	5,000 00		5,000 00
Purchase of new instruments for the band	1,400 00	9,686 50	
TRANSPORTATION AND RECRUITING.			
Transportation of troops and expenses of recruiting		7,000 00	5,000 00
REPAIR OF BARRACKS.			
At Portsmouth, N. H., Boston, Mass., Brooklyn, N. Y., League Island, Pa., Annapolis, Md., Headquarters, Washington, D. C., navy-yard, Washington, D. C., Gosport, Va., Mare Island, Cal., and for rent of offices where there are no public buildings		13,000 00	8,000 00
NOTE.—$6,000 of above required for general repairs marine barracks Brooklyn, N. Y., and $4,000 for general repairs marine barracks Mare Island, Cal.			
HIRE OF OFFICERS' QUARTERS.			
Now estimated for and paid by the paymaster			14,000 00
FORAGE.			
For three public horses, one for messenger to commandant and staff, Washington, D. C., and two for general use at marine barracks, Mare Island, Cal		500 00	4,000 00

Estimates of appropriations required for the fiscal year, &c.—Continued.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1879.
CONTINGENCIES.			
For freight, ferriage, toll, cartage, per diem for constant labor, funeral expenses of marines, stationery, telegraphing, apprehension of deserters, oil, gas, candles, repair of gas and water fixtures, water-rent, barrack furniture, furniture for government houses and offices, packing-boxes, bed-sacks, wrapping-paper, oil-cloth, crash, rope, twine, carpenters' tools, tools for police purposes, purchase of fire-extinguishers, purchase and repair of hose, repairs to public carryall, purchase and repair of harness, purchase and repair of hand-carts and wheelbarrows, purchase and repair of cooking-stoves, ranges, &c., stoves where there are no grates, gravel, &c., for parade-grounds, repair of pumps, and for other purposes		$20,000 00	$20,000 00
Total		213,981 50	214,000 00

W. B. SLACK,
Quartermaster, Marine Corps.

Approved and forwarded:
C. G. McCAWLEY,
Colonel Commandant.

HEADQUARTERS MARINE CORPS,
Paymaster's Office, September 21, 1878.

SIR: I respectfully submit herewith estimates for pay of officers, non-commissioned officers, musicians, privates, and others of the United States Marine Corps, for the fiscal year ending June 30, 1880.

These estimates show an increase of $33,582 over the sum appropriated for the present fiscal year, as follows:

For additional pay to officers for five years' service	$1,380
For pay of officers since placed on the retired-list	5,355
For increase to pay of leader of the band	132
For additional pay to privates for five years' service	6,000
For additional, for pay of ten clerks and two messengers	5,715
For payments to soldiers for clothing undrawn	5,000
For commutation of quarters for officers	10,000
Total increase	33,582

I am, very respectfully, yours, &c.,

GREEN CLAY GOODLOE,
Major and Paymaster, Marine Corps.

Col. CHAS. G. McCAWLEY,
Commandant United States Marine Corps, Headquarters.

Approved and forwarded.

C. G. McCAWLEY,
Colonel Commandant.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1880, by the Paymaster of the United Marine Corps.

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
PAY OF OFFICERS, NON-COMMISSIONED OFFICERS, MUSICIANS, PRIVATES, AND OTHERS OF THE UNITED STATES MARINE CORPS; FOR PAYMENTS TO DISCHARGED SOLDIERS FOR CLOTHING UNDRAWN, TRANSPORTATION OF OFFICERS TRAVELING WITHOUT TROOPS, AND COMMUTATION OF QUARTERS FOR OFFICERS WHERE THERE ARE NO PUBLIC BUILDINGS.			
1 colonel commandant	Rev. Stat. p. 271, sec. 1596; sec. 1623; acts of June 30, 1834 (4 Stat. at L., p. 713, secs. 4, 5), March 2, 1847 (9 Stat. at L., p. 155, sec. 3), August 5, 1854 (10 Stat. at L., p. 586, sec. 1), February 21, 1857 (11 Stat. at L., p. 163, sec. 1), July 17, 1862 (12 Stat. at L., p. 594 sec. 2) June 30, 1864 (13 Stat. at L., p. 144, sec. 1), March 3, 1865 (13 Stat. at L., p. 487, sec. 1), July 28, 1866 (14 Stat. at L., p. 334, sec. 13), July 28, 1866 (14 Stat. at L., p. 337, sec. 37), March 2, 1867 (14 Stat. at L., p. 422, sec. 1), July 15, 1870 (14 Stat. at L., p. 517, sec. 7), January 18, 1875 (18 Stat. at L., p. 301, sec. 1); Navy Regulations, July 18, 1816.	$4,500	
1 colonel		4,500	
2 lieutenant-colonels		8,000	
1 adjutant and inspector, 1 quartermaster, and 1 paymaster, 2 at $3,500, and 1 at $3,000 per annum		10,000	
4 majors		14,000	
2 assistant quartermasters, 1 at $2,800 and 1 at $2,600 per annum		5,400	
20 captains, 1 at $2,520 and 19 at $2,340 per annum		46,980	
30 first lieutenants, 15 at $1,950, 13 at $1,800, and 2 at $1,650 per annum		55,950	
20 second lieutenants, 11 at $1,540 and 9 at $1,400 per annum		29,540	
1 brigadier-general, retired-list		4,125	
1 lieutenant-colonel, retired-list		3,000	
4 majors, retired-list, 3 at $2,625 and 1 at $2,250 per annum		10,125	
1 assistant quartermaster, retired-list		2,100	
3 captains, retired-list, 1 at $1,620, 1 at $1,485, and 1 at $1,350 per annum		4,455	
2 first lieutenants, retired-list		2,700	
3 second lieutenants, retired-list, 1 at $1,155 and 2 at $1,050 per annum		3,255	
1 leader of the band		1,080	
1 sergeant-major, 1 quartermaster-sergeant, and 1 drum-major		1,080	
50 first sergeants		16,200	
140 sergeants, 90 at $17 and 50 at $22 per month		31,560	
180 corporals, 130 at $15 and 50 at $20 per month		35,400	
30 musicians, 7 at $40, 8 at $26, and 15 at $23 per month		9,996	
96 drummers and fifers		17,736	
1,500 privates, 600 at $13, 500 at $16, and 400 at $18 per month		276,000	
10 clerks and two messengers		15,715	
Payments to discharged soldiers for clothing undrawn		20,000	
Transportation of officers traveling without troops		5,000	
Commutation of quarters for officers where there are no public buildings		10,000	
		648,397	$614,815

GREEN CLAY GOODLOE,
Major and Paymaster, Marine Corps.

HEADQUARTERS MARINE CORPS,
Paymaster's Office, September 21, 1878.

Approved and forwarded:
C. G. MCCAWLEY,
Colonel, Commandant.

UNITED STATES MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September 25, 1878.

SIR: I herewith respectfully inclose, to be forwarded to the Honorable Secretary of the Navy, abstract in duplicate of proposals to furnish rations, fuel, and supplies to the United States Marine Corps during the fiscal year ending June 30, 1879.

I am, very respectfully, your obedient servant,

W. B. SLACK,
Quartermaster, Marine Corps.

Col. C. G. McCAWLEY,
Commandant United States Marine Corps, Washington, D. C.

Approved and forwarded.

C. G. McCAWLEY,
Colonel Commandant.

Abstract of proposals received for furnishing rations, fuel, and supplies to the United States Marine Corps under the cognizance of the Quartermaster's Department.

PROPOSALS FOR RATIONS, UNDER ADVERTISEMENT DATED APRIL 30, 1878.

Stations.	Bidders.	Rations, per hundred.
Portsmouth, N. H	N. F. Mathes	$14 89
	John C. Gilbert	18 00
	Kimberly Bros	14 89
	H. W. Hall	*14 84
	Peters Bros	17 93
	Cyrus L. Brown	14 90
Charlestown, Mass	N. F. Mathes	16 50
	Peter Higgins	15 19
	John C. Gilbert	16 50
	Kimberly Bros	16 74
	H. W. Hall	*15 00
	John Mullett	19 22
	Peters Bros	18 00
Brooklyn, N. Y	N. F. Mathes	17 25
	John C. Gilbert	15 19
	Kimberly Bros	15 00
	H. W. Hall	*14 70
	John Harrison	15 25
	Stephen H. Mills & Co	18 00
	Peters Bros	17 80
	Jacob M. Evans	30 00
League Island, Pa	N. F. Mathes	17 70
	John C. Gilbert	22 00
	Kimberly Bros	16 74
	Samuel T. Reckless	20 00
	H. W. Hall	*15 00
	John Benezet	16 15
	Theo. Cantield, jr	17 25
	Peters Bros	18 00
	James I. Convery	19 75
Washington, D. C	J. T. Varnell	14 45
	N. F. Mathes	16 75
	John C. Gilbert	15 19
	Kimberly Bros	15 02
	Joseph G. Carroll	16 00
	H. W. Hall	*13 40
	Peters Bros	17 50
Gosport, Va	John H. Cannon	17 44
	N. F. Mathes	17 50
	John C. Gilbert	20 00
	Kimberly Bros	15 09
	H. W. Hall	*14 50

*Accepted.

Abstract of proposals received for furnishing rations, fuel, &c.—Continued.

Stations.	Bidders.	Rations, per hundred.
Gosport, Va.—Continued	Peters Bros	$17 40
	Washington Taylor & Co	17 75
	Evans & Burwell	15 60
Annapolis, Md	N. F. Mathes	19 50
	John C. Gilbert	21 00
	Kimberly Bros	15 09
	H. W. Hall	*14 70
	Peters Bros	17 90
Mare Island, Cal	N. F. Mathes	*19 94
	Kimberly Bros	17 74
	H. W. Hall	*17 34
	J. A. McInnis	20 99
	John E. Williston	23 00

* Accepted.

PROPOSALS FOR FUEL UNDER ADVERTISEMENT APRIL 30, 1878.

Stations.	Bidders.	Wood, per cord.	Coal, per ton.
Portsmouth, N. H	N. F. Mathes	*$5 22	*$5 20
	George A. Hammond	8 00	....
	Russell & Odion	6 00	5 50
	W. H. Sise	....	5 24
	Peters Bros	9 00	8 00
	Cyrus L. Brown	5 25	....
Charlestown, Mass	J. A. Wellington & Co	8 00	5 75
	C. A. Campbell	7 00	*5 28
	Peters Bros	9 00	8 00
	Cyrus L. Brown	*5 75	....
Brooklyn, N. Y	Murtha & Boyle	....	5 50
	Clark & Wilkins	*7 28	....
	Albert T. Nathans	7 80	5 95
	B. F. Jayne & Co	8 40	*4 48
	Peters Bros	9 00	7 00
Philadelphia, Pa	James J. Convery	*6 40	*5 25
	Peters Bros	9 00	....
Washington, D. C	T. B. Cross, jr	4 28	4 45
	John Miller	4 34	4 73
	Stephenson Bros	5 00	5 20
	Norman L. Fowler	*4 00	4 55
	Samuel Emery	4 75	5 20
	Johnson Bros	4 40	4 67
	L. W. Guinand	4 39	4 43
	Z. Williams	4 25	*4 30
	Peters Bros	9 00	7 00
Gosport, Va	Brickhaus & Barclay	*3 50	....
	John Miller	6 00	6 00
	John W. Oast	4 00	....
	Peters Bros	4 23	*4 87
Annapolis, Md	John Miller	*5 50	....
	Norman L. Fowler	6 00	....
	Johnson Bros	6 00	....
	Peters Bros	10 00	....
Mare Island, Cal	A. Powell	*8 00	15 50
	A. M. Ebbetts	10 49	13 95
	James McCudden	8 25	13 95
	Aden Bros	8 95	17 50
	Haste & Kirk	8 90	*13 25
	William Walker	8 00	14 00

* Accepted.

Abstract of proposals received for furnishing rations, fuel, &c.—Continued.

OFFERS FOR SUPPLIES UNDER ADVERTISEMENT DATED MAY 20, 1878.

Classes.	Bidders.	Amount.
Class No. 1.—Sky-blue kersey, dark-blue coat cloth, scarlet cloth, and flannel.	Wilson and Bradbury	$13,200 00
	B. Y. Pippey	*13,637 50
Class No. 2.—Dark-blue flannel, gray blankets, woollen socks.	Joseph Elinger	11,120 00
	Wilson and Bradbury	12,180 00
	Charles W. Hayes	†8,832 00
	S. M. Heilbrun	†500 00
	B. Y. Pippey	†12,396 00
Class No. 3.—Linens, Canton flannel, and ticking.	Joseph Elinger	3,525 00
	Wilson and Bradbury	†2,812 50
	Charles W. Hayes	†3,161 80
	B. Y. Pippey	†3,152 50
Class No. 4.—Hats, pompons, &c	D. L. Kattshofski	1,926 00
	Joseph Elinger	3,347 00
	Charles W. Hayes	786 00
	J. H. Wilson	3,450 60
	E. R. Lyon	4,559 50
	B. Y. Pippey	802 50
	Charles F. Bush	†5,093 55
	Horstmann Bros. & Co	†4,340 65
Class No. 5.—Buttons, bullion, yellow and scarlet lace.	F. W. Maurer	†166 50
	Paul J. Field	†874 40
	J. H. Wilson	†886 05
	S. M. Heilbrun	†505 04
	Horstmann Bros. & Co	†1,403 05
Class No. 6.—Infantry and arctic shoes	John Mundell & Co	9,262 50
	Hecht Bros. & Co	†8,500 00
	Bay State Shoe and Leather Company	9,000 00
	Charles W. Hayes	†767 50
Class No. 7.—Cartridge-boxes, &c	J. H. Wilson	†2,438 00
	S. M. Heilbrun	1,267 40
	Joseph Cogan	2,760 00
	Horstmann Bros. & Co	†2,268 30
Class No. 8.—Making and trimming of clothing	D. L. Kattshofski	‡7 77
	Joseph Elinger	23 25
	Joseph W. Thorp	12 19
	B. Y. Pippey	*12 10

* Accepted. † Accepted for part of class. ‡ Bid for part of class.

UNITED STATES MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September, 1878.

W. B. SLACK,
Quartermaster, Marine Corps.

No. 12.—REPORT OF COMMISSION ON SITE FOR NAVAL OBSERVATORY.

AN ACT to appoint a commission to ascertain the cost of removing the Naval Observatory.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President be, and he is hereby directed to appoint, by and with the advice and consent of the Senate, a commission consisting of three persons, one of whom shall be a Real Admiral of the Navy, one of whom shall be a Colonel of Engineers, and one shall be chosen from civil life, whose duty it shall be to select a site, within the District of Columbia, for the United States Naval Observatory, such site to possess relatively the advantages of healthfulness, clearness of atmosphere, convenience of access from the City of Washington, and such other advantages as may be found expedient, and to report fully thereon including estimates of the total expense of said site and the removal of the Observatory, to the next session of Congress: *Provided, however*, That no member of said commission shall be, directly or indirectly, interested, for himself, or for any other person, in any property to be selected as a site for said Observatory.

SEC. 2. Said commission shall invite sealed proposals or offers of sale from the owners of land deemed fit for such a site, containing such provisions as they may deem sufficient to bind such owners to convey such land to the United States in case the same shall hereafter be selected and determined on as the site of said Observatory; which proposals shall be opened by the full commission publicly, and in the presence of persons interested who may choose to attend, on a day to be fixed for that purpose, after due notice to all parties interested; and no proposal received after such formal opening shall be opened or considered.

SEC. 3. Said commission shall also consider and report upon the propriety and expediency of disposing of the old observatory grounds and buildings, the best and most advantageous method of selling the same, and the probable sum which may be realized therefore.

SEC. 4. Said commissioners may if they deem it necessary in order to secure the best site for said observatory examine any premises within said District not offered for sale as before provided which may seem eligible, and may report their estimate of the cash market value of the same.

Approved, June 20, 1878.

To the PRESIDENT OF THE UNITED STATES:

The undersigned, commissioners appointed by the President under the act above cited respectfully report that they entered upon their duties by meeting at the Navy Department, Washington, and organizing, on the 15th of July, 1878; Rear-Admiral Ammen acting as chairman under appointment.

To fulfill the second section of the law, the commission proceeded at once to prepare a form of advertisement, inviting "sealed proposals," or "offers of sale," of which a copy (marked A) is appended to this report.

This advertisement was published weekly in eight of the Washington papers from July 29 to the day fixed for the public opening of the bids (August 28).

On the 28th of August, at 12 o'clock, the proposals were publicly opened by the commission in the board room of the Navy Department, in the presence of a large number of parties interested. Seventy-nine proposals were received, a schedule of which (marked B) will be found appended to this report.

As the analyzing, arranging, recording of the bids, and locating the situations on the chart of the District required time and considerable clerical labor, and as the commissioners were individually under pressure of other duties or engagements, it was concluded to adjourn till the 8th (subsequently changed to the 14th) of October; the two commissioners residing in or near Washington—the chairman being one—to make in the mean time preliminary examinations of all the sites offered. During the interval which elapsed between the adjournment and succeeding formal meeting (October 14) such preliminary examinations were made by personal visits of both the resident commissioners to all the sites offered.

On the 14th of October the commissioners assembled again, and after discussion and consideration of the results of the preliminary examinations, proceeded, accompanied by the Superintendent and Professor Hall, of the Observatory, to revisit all the sites for which those examiations had shown any considerable claims of eligibility.n

Subsequently, at the suggestion of the commission, the entire corps of professors on duty at the Observatory (five in number) was directed by the Superintendent to visit all the sites which the examinations already described brought within the category of superior eligibility.

The result of these repeated and varied examinations was to reduce to a very small number the locations from which the choice should be made. Of these, No. 18 of the schedule, known as "Clifton," formerly owned and improved by Col. Charles Ellet, and now the property of James Elverson, of Philadelphia, was placed originally either first, or in a very high grade of eligibility, by all who made the examinations, whether members of the commission or experts of the Observatory, and it was the *first* choice of a large majority. It may, therefore, be called their unanimous choice, as combining as well or better than any other the "advantages of healthfulness, clearness of atmosphere, convenience of access from the city of Washington," commanding position, abundant supply of pure water; with seclusion, exemption from the heated air and smoke of the city, and from dust; from disturbance by railways or roads, and (owing to the contour of the ground) from detrimental occupation of closely-adjoining lands. We may properly add, that the Observatory would be in full view from the Capitol, which, from base to summit, is seen from the proposed site.

Again, while in the location of a national institution so important as this Observatory, the commissioners would not allow the question of mere cost of site to overrule that of eminent fitness, yet, other things being nearly equal, their obvious duty has been to give a proper weight to comparative cost. An examination of the schedule of bids will show that of land not very remote, or of sites at all well situated, it is among the least costly, while contiguous to the site, on Rock Creek, are quarries of building stone available for the new structures.

The tract is directly west of Rock Creek and north of Georgetown Heights, from which it is separated by the deep valley of a small tributary to Rock Creek. The opposite slopes of the valley are occupied by the Oak Hill Cemetery and the grounds and residences marked on Boschke's chart "Boyce," "Linthicum," and others, fronting on Road street. On the east, the site slopes toward Rock Creek, from which, however, it is separated by a narrow strip of land. On the north is the valley of another small tributary of Rock Creek, and the grounds and house (marked on the chart "R. Barnard's heirs") now owned by Dr. Cissel. The ravine first named bounds the property on the west, beyond which are the grounds of Mr. Weaver and others, lying on the Tennallytown road. Northwest, having a short length of boundary line in common, are the residence and beautiful grounds of Mrs. Barber, a place which favorably competed with this for choice. Portions of the two small tributaries of Rock Creek mentioned run within the limits of the chosen site, and an unusually fine spring is located convenient to the highest ground; these, by means of rams, or other machinery, will furnish an ample supply of water for all purposes, precluding an unsatisfactory dependence on wells and rain-water collection, on which many of the sites we have examined would mainly depend for water-supply.

Gas is easily made available from Georgetown, and even the high-service Potomac-water supply can be resorted to, if it ever be deemed expedient. The elevation is roughly determined at 230 feet, a height 130 feet greater than that of the present Observatory, and one regarded as quite sufficient.

The present access is by Pennsylvania, Massachusetts, or Connecticut avenues, to Road street, Georgetown, whence a branch road, a few rods in length, lying between the Boyce and Linthicum estates, leads direct to the property. The distance is comparatively short.

The commissioners believed that the requirement of the law as to "convenience of access from the city of Washington" for such an establishment, where a degree of seclusion is desirable, to be sufficiently fulfilled;

but free right of way having been offered from Road street, Georgetown, through the Linthicum estate, and from the Tennallytown road through the land of Mr. Joseph Weaver, these concessions have been obtained in writing. The possession of these rights gives varied direction of immediate access and amelioration of grades. Copies of the conceded rights of way will be found in papers marked C and D.

The future extension of Massachusetts avenue will strike the southern slope of the "Clifton" hill, and thus give an air-line approach.

The area of the chosen site is about what the commissioners originally named as the most desirable for the new establishment. There is amply sufficient extent of plateau, nearly level, for the Observatory building; while the slopes offer convenient sites for officers houses, to be located below the horizontal range of vision from the Observatory. The existing dwelling, a three-story frame building, in good repair, though not of modern construction, may perhaps be made available; but not improbably must be removed, as occupying ground needed for the Observatory, or as obstructing the range of the instruments. Its value is not, therefore, considered in determining the choice. And we might here incidentally remark, that costly dwellings which, in some few cases, occupy other proposed sites and enhance their price, are all subject to the same comment.

Closely adjoining the northwestern corner of the property is a quite small area of ground comprised within the boundaries of Dr. Cissel's property (the "R. Barnard" place of Boschke's map) which is a few feet higher than the plateau of the chosen site. The astronomers of the Observatory do not regard this as at all objectionable as it now is; but as they think it might be made somewhat so by the erection of buildings, a tract of 3¼ acres in extent, which more than comprises the area in question, has been purchased by Mr. Elverson, and added to the 41¾ acres of the "Clifton" place, thus making up the total of 45 acres offered in his original bid.

In a region possessing so many advantageons and beautiful sites, it is scarcely necessary to say that the commissioners, in making choice of one, by no means deny high claims to a great many others offered to them. Some which possess very eminent claims of a certain kind may be either too near the railroads or highways; too close to the dense portions of the city, the dust, smoke, and heated air of which are objectionable; or liable to be surrounded with buildings on contiguous ground; or, on the other hand, too remote and inaccessible; too scantily supplied with water, badly shaped topographically, &c.

Finally, the commissioners respectfully report that in fulfillment of their duties under the first and second clauses of the act, they have chosen the property known as "Clifton," and described in the proposal or bid No. 18 of the schedule, of which a copy, with plat, is appended (marked E); the area of the same being (including the small tract added from Dr. Cissel's place) 45 acres; the cost $667 per acre, or $30,015.

Besides the choice of site the duty is imposed on the commissioners "to report fully thereon, including estimates of the total expense of said site and the removal of the Observatory." It became necessary as a preliminary to the execution of the latter duty to inform ourselves as to the general features and exigencies of structures which shall supersede the existing ones; for "removal" in this case means new construction, which should be on new and improved plans. For this purpose conference was had with the Superintendent of the Observatory, Rear-Admiral John Rodgers, who attended several of our meetings and accompanied us to the Observatory to examine the present arrangements and their uses. He also exhibited to the commission a plan and elevation of a proposed

new Observatory building, embodying arrangements approved not only by the executive officers of the Observatory, but also by the eminent astronomers of the United States, whose views were obtained in answer to a circular letter generally distributed.

While there is no power given the commission or to others to decide upon a particular plan, some such provisional plan, as a basis of the estimates required, was indispensable to an intelligent execution of the law. We deem it proper to say, however, that our own general views correspond with those which characterize the plans submitted to us, and on which we have based our estimates, viz: That in constructing these buildings, a National Observatory should be provided, which, while satisfying the practical astronomical exigencies of the military and commercial marine of the United States, shall also meet the higher and more universal demands of science, by equality in all its material means with other great national observatories.

The general arrangements involved in the designs submitted to us have been governed by this idea.

The paper appended (marked F) gives, as furnished by the Superintendent, a brief description of the proposed building; its general shape and a statement of the use and necessity of each and all the rooms, domes, and appurtenances. The description is illustrated by a photolithographic sheet showing the ground plan and horizontal sections of the basement and upper stories.

In carrying out the design the commissioners believe that, avoiding unnecessary costliness either in materials used or in producing architectural effects, the building should be, if simple, yet architecturally creditable; and moreover that it should be fire-proof.

Appended to this report is a "specification" (marked G) in detail of the material character of the proposed construction, accompanied by an estimate of cost.

The various items of cost, after computations of quantities of materials and workmanship, were verified by consultation with responsible undertakers or furnishers of the various kinds of work and objects enumerated. The total cost, so ascertained on the basis assumed, was found to be $161,364.68.

Considering, however, that no complete design has been yet prepared and that the present rates for materials and workmanship are exceptionally low, we deem it prudent, in order to cover such contingencies, and likewise the cost of surveys, and architect's work and superintendence, to add an item of 25 per cent. to the above.

We are now prepared to estimate the total expense of the site and of the removal of the Observatory as follows:

Cost of site	$30,015 00
Amount of estimate for Observatory building	161,364 38
Contingencies on same, 25 per cent	40,341 09
Removal of instruments	3,000 00
Furnishing, including, besides necessary room furniture, the cost of instrument-cases and shelves; library shelves (the iron frame-work being included in cost of building): computing and drawing tables, &c	5,000 00
Inclosure (substantial wooden fence)	3,500 00
Superintendent's and professors' quarters, and buildings for persons employed	85,000 00
Expenses connected with the site which cannot now be minutely estimated, such as additional grading and road-making; improvement of grounds: apparatus, or machines external to the buildings themselves; for introducing gas or water, &c	21,779 53
Total	350,000 00

Making a general total of three hundred and fifty thousand dollars.

It should be remarked that the items for "removal of instruments," for "furniture," for "Superintendent's and professors' quarters," &c., have been obtained from the Superintendent, Rear-Admiral Rodgers.

A copy of the estimates furnished us for accessory buildings is appended (marked H). It is based on the assumption that all persons connected with the Observatory shall reside on the grounds. At present the professors or astronomers of the institution have no adjacent residences provided, a deficiency which ought to be remedied in the new establishment, since only by such close contiguity can all the moments of the night favorable for observation be fully secured.

The item for accessory buildings is perhaps somewhat in excess of present necessity, but it has been deemed proper to make it ample for the ultimate needs of an observatory of the first magnitude as this is designed to be.

We now turn to the duty assigned us in the third section of the act.

The commissioners are unanimously of the opinion that it would not be advisable to dispose of the site of the existing Observatory at present:

First. Because the present depressed condition of the real-estate market would prevent the realization of its true value; and

Second. Because the same feature of the ground which would make it less valuable for private purposes, namely, its height above the grade of the surrounding streets, gives it additional value for public purposes, in the large quantity of material furnished by that elevation, all of which must eventually be used in filling the marshes bordering the river in the immediate neighborhood. In this connection the "Board of Survey," for the improvement of the harbors of Washington and Georgetown, organized by act of Congress approved March 5, 1872, reports, §46, as follows:

> Reservation No. 4, at the southwest edge of the city, on the Potomac * * * is located on a high hill, requiring very steep grades in the adjacent streets. Along the foot of this hill runs the water front in such close proximity as to render it totally unsuitable for any business purposes. The necessities of the improvements in this part of the city demand the reduction of this hill and high grounds to such grades as the authorities of the District may deem necessary to meet the emergencies of the case. Unfortunately, upon this reservation is located one of the best, most ably conducted and valuable scientific institutions of the government, viz, the Naval Observatory. Although it is most important that this hill be reduced, it should not and must not be at the expense of the slightest injury to this important observatory, but, on the contrary, to its great advantage.
>
> Very much better locations can be found within the District. * * *
>
> The materials from this hill can be most profitably used for filling the low grounds between it and Seventeenth street west, as well as the reclaimed lands.

The now intended removal of the Observatory leaves the site free to be adapted to the exigencies of harbor and water-front improvement; to furnish its surplus earth to the purposes for which the board of survey demands it.

A careful topographical survey of the reservation has been made by Professor Harkness, the result of which is to ascertain the amount of earth above the probable grade-surface to be 1,075,900 cubic yards; enough to raise 10 feet a superficial area of 326,000 square yards, a large proportion of the extensive area mentioned by the board of survey as well situated to receive it. An execution of the plan, if ever undertaken, will therefore require, and make it important to have at command, all of this earth.

It would seem wise, therefore, in this point of view, as well as on account of the inadequate price which could now be obtained, to retain the present reservation, the market value of which would be greatly enhanced by the grading. A plat of the ground, with the contour lines

drawn and the position of the buildings shown, is annexed to this report (marked I).

It has been officially appraised, in response to the call of the honorable Secretary of the Navy, for making up an inventory of property belonging to the Navy Department, at $8,000 per acre, or $142,000 for the whole area of 17.85 acres. The commissioners do not think that more than a small fraction of this sum could now be realized if exposed for public sale. If retained, as we recommend, we feel confident not only that better prices can be ultimately obtained, but that the intrinsic value will increase; but any estimate we could now make of such value would be illusory, as it would depend not merely on the restoration of values of real estate and the normal growth of the city, but upon contingent works of harbor and water-front improvements.

We consider it best to dispose of the materials contained in the existing buildings as soon as they are evacuated, at public sale, rather than suffer them, by remaining unoccupied, to become dilapidated.

The brick wall surrounding the reservation contains about 400,000 bricks. These and the bricks contained in the buildings themselves, about one-fourth as many more, cannot be estimated higher than $2 per thousand, from all which perhaps $1,000 may be realized, and from the sale of other materials, including doors and frames, window-sashes and frames, metals and pipes or heating apparatus, a few thousand dollars more; perhaps $5,000 in all, which, therefore, is the "probable sum that may be realized" for the improvements; the only sum which at present, under our point of view, the government could realize from the grounds and buildings, retaining, however, the ground for an ultimate enhanced future value and for use of its superfluous earth in the improvement of the water-front.

Respectfully submitted.

DAN'L AMMEN,
Rear-Admiral and Chairman of Commission.
J. G. BARNARD,
Colonel of Engineers, Brevet Major-General, U. S. A.
LEONARD WHITNEY.

NAVY DEPARTMENT,
Washington, D. C., December 7, 1878.

A 1.

PROPOSALS FOR SITE FOR NAVAL OBSERVATORY.

NAVY DEPARTMENT,
July 16, 1878.

The undersigned have been appointed a commission under an act of Congress approved June 20, 1878, "to select a site within the District of Columbia for the United State Naval Observatory; such site to possess relatively the advantages of healthfulness, clearness of atmosphere, convenience of access from the city of Washington, and such other advantages as may be found expedient; and to report fully thereon, including estimates of the total expense of said site, and the removal of the Observatory, to the next session of Congress."

The second section of said act reads as follows:

SECTION 2. Said commission shall invite sealed proposals or offers of sale from the owners of land deemed fit for such a site containing such provisions as they may deem

sufficient to bind such owners to convey such land to the United States in case the same shall hereafter be selected and determined on as the site of said Observatory; which proposals shall be opened by the full commission publicly, and in the presence of persons interested who may choose to attend, on a day to be fixed for that purpose, after due notice to all parties interested; and no proposal received after such formal opening shall be opened or considered.

In accordance with the above provisions, sealed proposals for such site will be received until noon of the 28th day of August next, at which time they will be publicly opened at the Navy Department in the presence of such persons interested as may choose to attend, and this is due notice of said opening.

Proposals must be indorsed "Proposals for site for Naval Observatory," and directed to the "Commission to ascertain cost of removing the Naval Observatory, care of the Secretary of the Navy."

Said proposals must give metes and bounds by which the property is described, and be accompanied with a plat of the same, and conform to conditions of the second section of the act above quoted.

The quantity of land required will be not greater than fifty (50) acres, nor less than twenty (20) acres, and the price must be stated per acre, subject to accurate survey.

If parties offering a tract larger than twenty (20) acres are willing to give the option of taking any quantity not less than that area at the stipulated or a modified price, they will so state in their proposals.

Blank forms for proposals may be obtained at the Navy Department.

Proposals must be signed by the owner or owners of the property.

DANIEL AMMEN,
Rear-Admiral, U. S. N.
J. G. BARNARD,
Colonel and Brevet Major-General.
LEONARD WHITNEY.

A 2.

COPY OF BLANK FORM.

Proposal for sale to the United States of a site for the Naval Observatory.

To the Commission to ascertain cost of removing the Naval Observatory:

GENTLEMEN: The undersigned, owner of the property hereinafter described, hereby offer and agree to sell the same to the United States, and guarantee good title, for the sum of ——— dollars per acre; or to give the United States the option to take any portion of the same at ——— dollars per acre.

Said property contains about ——— acres, and is situated ——— ———, and is more particularly described by the following metes and bounds:

The plat of the same, conforming to the above metes and bounds, is appended.

This offer and agreement to be binding upon the undersigned in case of the location of the said Naval Observatory upon the land above described, or any portion thereof.

And we further bind ourselves in the penal sum of ——— ——— for the faithful performance of this agreement.

B.

Schedule of offers from owners of land for proposed site for Naval Observatory under advertisement dated July 16, 1878.

[Bids received until noon August 28, 1878. Opened and scheduled August 28, 1878, under the direction of the commission appointed in pursuance of act of Congress approved June 20, 1878.]

NAVY DEPARTMENT,
August 28, 1878.

Number of bid.	Names of bidders.	Number of acres in tract.	Price per acre at option.	Price per acre for whole tract.	Remarks.
1	Ezra W. Clark	25.85	$800		
2	Gardner & Weaver	20	2,780		
3	......do	16	1,800		
4	Elizabeth A. Beale	30	1,000	$500 00	
5	Emery Chapel and others	2.68		*3,171 64	* Or $8,500 for whole.
6	David Moore	20	2,000		
7	J. H. C. Young, trustee	*66	*800	*600 00	* 50 acres offered at $600 per acre, or at option at $800 per acre.
8	Clagett & Van Riswick	108.6	325		
8½	......do	50		500 00	
9	......do	50		400 00	
9½	......do	50		300 00	
10	......do	20		1 00	
11	Otis S. Presbery and others	37		3,100 00	
12	......do	44		3,500 00	
13	King & Pettibone	20	350	300 00	
14	Elizabeth J. Stone	28	*7,840	7,840 00	* If not less than 20 acres are taken.
15	......do	29.2	5,227		
16	......do	30	3,920		
17	......do	35.5	3,049		
18	Elverson & Sherman	45	833	667 00	
19	Sally Smith	63	500	600 00	
20	H. F. Davis	38.25	1,200	850 00	
21	Sayles J. Bowen	50	350	250 00	
22	B. T. and S. A. Swart	80	300	300 00	
23	Jane J. Nicholson	40		650 00	20 acres, with improvements, at $440.
24	Mary M. Manning	50	1,000	1,000 00	
25	J. and M. A. Hoover	27.11	350	350 00	
26	Ida Moore	27		1,500 00	
27	Alexander Fairly	50		400 00	
28	M. J. Clark	15.5 *22		1,250 00 100 00	*Adjoining.
29	L. D. Means and A. F. Offutt	27.75	400	300 00	
30	Edwin O. Reed	20	2,500	2,500 00	
31	William Stickney, secretary				Number of acres and price per acre not stated.
32	Archibald White	50	1,200	1,200 00	
33	J. Addison Smith	42	400	250 00	
34	L. D. Means and A. F. Offutt	22	400	400 00	
35	William T. Okie	44.5	95	95 00	
36	W. W. Corcoran	104	200	200 00	
37	M. J. and R. M. Nourse	30	500	500 00	
38	L. D. Means and A. F. Offutt	49		600 00	$400 per acre for any part not including buildings, &c.
39	McCormick & Scaggs	45 or 50	*100	100 00	* If less than 10 acres, $125 per acre.
40	Sophia Snyder	91		500 00	Or a certain 42 acres, at $700, or any portion, not less than 20 acres, if laid off from east side of 42 acres, or give the option of taking the portion of said property farthest from Tennallytown road, containing about 49 acres, at $600 per acre, or any part of said portion, not less than 20 acres, for $650 per acre.
41	A. T. Brittan and W. B. Moses	22	1,500	1,000 00	
42	James L. Davis	42	500	400 00	
43	......do	46		600 00	
44	Mary and Elizabeth Queen	80	400	400 00	
45	H. C. Holt, M. D	25.73	2,000	2,000 00	
46	John A. J. Creswell and others	50	800	800 00	
47	......do	65	100	100 00	
48	H. S. Walbridge	90	1,000	650 00	
49	A. R. Shepherd and L. F. Hoffman	26 23.34		300 00 250 00	
50	Julia Lawson and V. Weaver	23		1,500 00	
51	B. H. Warner & Co	53.5	200	150 00	
52	......do	48	200	150 00	

Schedule of offers from owners of land for proposed site for Naval Observatory, &c.—Continued.

Number of bid.	Names of bidders.	Number of acres in tract.	Price per acre at option.	Price per acre for whole tract.	Remarks.
53	B. H. Warner & Co.	60	....	$300 00	$18,000 for whole.
54	......do	20	....	150 00	
55	Alfred D. Jessup	(*)	$500	500 00	*Number of acres not given.
56	Rev. P. T. Heally, president	75	....	300 00	*Or more.
		*50	....	500 00	
57	G. F. Green	44	1,250	1,000 00	
58	S. Blagden	347.56	500	275 00	
59	Valentine Walker	29.75	300	175 00	
60	L. R. Tuttle and George Bell	$18\frac{1}{3}$	....	3,340 00	Amounting to $45,838; error: should be $61,233.33.
		$7\frac{3}{8}$	....	....	For $40,000.
61	Jane McCrabb and C. A. Talbert	23.43	....	250 00	
62	George S. Lovett	40.75	3,000	2,000 00	
63	......do	23.66	....	6,500 00	
64	Christopher S. O'Hare	40	500	500 00	
64	......do	17	1,000	1,000 00	
65	Bridget Fitman heirs	30	350	300 00	
66	J. W. Paine and E. P. Warren	205	*1,500	1,000 00	*Of not less than 20 acres.
67	S. E. Middleton	34	1,500	1,200 00	
68	Mrs. S. M. J. Gales	50	2,000	2,000 00	Except northwest 10 acres.
69	M. C. Barber	70	....	1,428 57	$100,000 for whole tract.
70	Catharine P. French	125	500	500 00	
71	William Dickson, agent	40	600	500 00	
72	N. P. Chipman and others	40	*5,500	4,500 00	*It shall divide a line running parallel with Boundary street.
73	William Linkins and Jos. Casey	5	5,000	5,000 00	
74	H. Kengla and R. Britt	52.5	3,000	2,500 00	
75	M. A. Hunt and J. H. Kengla	43	....	2,000 00	
76	Jacob H. Kengla	35	....	1,000 00	
77	J. Pierce Klingle	50	....	1,000 00	
78	Archibald White	178	1,000	1,000 00	Except 20 acres, at $2,500 per acre.
79	George Taylor and others	29	....	*6,595 00	*Excluding the streets.
79	......do	29	....	*5,571 00	*Including the streets.
79	......do	....	....	....	NOTE.—Certain parties claim in addition to the price per acre for the above land the value of their improvements, amounting in all to $20,250. (See bid.)

C.

THE OAKS, GEORGETOWN HEIGHTS, D. C.,
November 23, 1878.

SIR: On condition that the United States Naval Observatory shall be located on the site known as "Clifton," adjoining us on the north, I offer, as trustee of the Linthicum estate, to give to the United States the free right of way through the land of said estate, for a road not exceeding sixty feet wide, to said Clifton, beginning on Road street at the head of Valley street, Georgetown, or thereabout, and running by the most direct and suitable route, to be located by the United States engineer, to a point just above the dam on the Linthicum land, on the boundary line of the two places: said right of way to terminate whenever said Clifton shall be abandoned, if ever, as the site for said Observatory.

On the return of my co-trustee, Mr. William Laird, jr., who is now absent from the District, a more formal agreement can be executed, if desired, embodying the conditions contained in a draft which I have received from Mr. Whitney.

Very respectfully, &c.,

JOSIAH DENT,
Trustee.

Rear-Admiral DANIEL AMMEN, U. S. N.,
Chairman.

D.

This indenture made this twenty-seventh day of November, 1878, between Joseph Weaver, of the District of Columbia, party of the first part, and the United States of America, party of the second part, witnesseth:

That whereas it is contemplated that the party of the second part may locate and erect a new Naval Observatory building on the property known as "Clifton," situated north of Georgetown, in the District of Columbia, and now owned by James Elverson, of the city of Philadelphia, State of Pennsylvania, which property of "Clifton" adjoins the lands of said party of the first part: Now, therefore, the said party of the first part, for and in consideration of the sum of one dollar to him in hand paid by said party of the second part, the receipt whereof is hereby acknowledged, and upon the condition that said Observatory shall be located as aforesaid, does agree for himself, his heirs, and assigns, to grant, and does hereby grant to the said party of the second part, a free right of way for a roadway to said property known as "Clifton," through the lands of said party of the first part, from the Tennalytown Road—said roadway to be located on a straight line parallel to the line which runs N. 62° E. between the land now owned by heirs of Morris Adler and the lands of the party of the first part, and the southernmost boundary of said roadway to be five feet distant from said line, so as to reserve to the party of the first part the control of the strip of ground five feet wide between said roadway and the said land of heirs of Morris Adler, the said roadway to be not more than sixty feet in width, and to be opened, improved, and maintained at the cost of said party of the second part. And said party of the first part, for himself, his heirs and assigns, does further agree that he or they will, on demand of the party of the second part, execute such other instruments of writing as the Attorney-General of the United States may deem necessary to carry into effect the true purpose and meaning of this indenture.

JOSEPH WEAVER.

COUNTY OF WASHINGTON, *to wit:*

I, Mayhew Plater, a notary public in and for said county, in the District of Columbia, do hereby certify that Joseph Weaver, party to aforegoing deed bearing date this twenty-seventh day of November, 1878, personally appeared before me, in my county aforesaid, the said Joseph Weaver being personally well known to me to be the person who executed said deed, and acknowledged the same to be his act and deed.

Given under my hand and notarial seal this twenty-seventh day of November, 1878.

MAYHEW PLATER,
Notary Public.

E.

PROPOSALS FOR SALE TO THE UNITED STATES OF A SITE FOR THE NAVAL OBSERVATORY.

To the Commission to ascertain cost of removing the Naval Observatory:

GENTLEMEN: The undersigned, owner of the property hereinafter described, hereby offers and agrees to sell the same to the United States, and guarantee good title, for the sum of $30,000, or $677 per acre, or to

give the United States the option to take any portion of the same at $833 per acre.

Said property contains 45 acres, and is situated in the county of Washington, being parts of a tract of land called "the Rock of Dunbarton," or the addition to the Rock of Dunbarton, or "Pretty Prospect," or "CLIFTON," consisting of four several parts, now united in one, which were held by Brooke Mackall, and by him sold to Henry Gildemiester, and is more particularly described by the following metes and bounds: Bounded on the south by the lands of Edward Linthicum; on the west by the lands of Morris Adler and E. A. Eliason; on the north by the lands of Margaret C. Barber and Robert Barnard's heirs; and on the east by the lands of William Morton and Robert Barnard's heirs; containing in all 45 acres, more or less, being the same land conveyed, under date of May 20, 1857, by Charles Ellet, jr.; said deed being recorded in liber J. A. S., No. 131, folio 189, *et seq.*

Should the commissioners prefer "Clifton," but think the price higher than that asked for desirable property, I will agree to convey the whole or, say, 30 acres of the above at a fair valuation, said valuation to be made by competent parties appointed by the commissioners. The plat of the same, conforming to the above metes and bounds, is appended.

This offer and agreement to be binding upon the undersigned in case of the location of the said Naval Observatory upon the land above described, or any portion thereof.

And we further bind ourselves in the penal sum of $2,000, for the faithful performance of this agreement.

JAMES ELVERSON,
JOHN SHERMAN,
Saint Cloud Building.

E.

To the Commission to ascertain the cost of removing the Naval Observatory:

GENTLEMEN: Having proposed to your commission to sell the property known as "Clifton" to the United States as a site for the Naval Observatory, and as it is represented that it contains a less area than was supposed by me when the proposition was submitted, by about $3\frac{1}{4}$ acres; and as it is further represented that the same amount of the high ground adjoining said "Clifton" on the northwest, belonging to Dr. R. S. T. Cissel, would be a desirable addition to "Clifton" as a site for the Observatory, I now state that I have acquired title to said high ground, about $3\frac{1}{4}$ acres in extent, and hereby obligate myself, in case "Clifton" is selected as the site for the Observatory, to include said tract in the conveyance of said "Clifton" to the United States at the same price per acre, namely, $667, leaving it optional with the United States to accept or reject such proposed addition.

Said proposed addition is more particularly described as follows: Beginning for the same at a black-oak tree in the northernmost corner of "Clifton," which tree is also the corner between "Clifton," "Normanstone," and the lands of Mrs. M. C. Barber; thence running northwestwardly, on the line between "Normanstone" and the said lands of Mrs. Barber, 25 perches; thence south 87 degrees east, 10 perches; thence south 30 degrees east, 16 perches; thence south 2 degrees west, 23 perches, more or less, to the boundary line between "Normanstone" and "Clifton"; thence with said boundary line to the place of beginning; containing $3\frac{1}{4}$ acres, more or less.

JAMES ELVERSON.

WASHINGTON, D. C., *December* 4, 1878.

F.

GENERAL DESCRIPTION OF PROPOSED OBSERVATORY BUILDING.

The main building runs 142 feet east and west, with wings, making the whole front 239 feet long, and an extension from its central part runs 172 feet south of the main building.

The shape is deemed most advantageous in practice. Extension east and west is needed, in order to get space for the transit rooms, which need a clear view north and south, and practical isolation; and the large telescope is placed at the south end of the extension, since the planets moving in the ecliptic, a clear view of it, unobstructed by impediments of any kind, is most important.

The library is convenient to all parts of the Observatory, and the distance of the great telescope is purposely made great, since this distance is usefully employed in the prime-vertical room and computing-room for the necessary calculations of the observers.

The body of the main building is not more extended than the uses of the institution demand. Not a single room can be considered a large one, except possibly the library, of which the size is made necessary by our constantly increasing store of books.

The accompanying general plan may be consulted in connection with the description.

General description.

The proposed Observatory building consists of—

A main building, 142 feet 4 inches by 55 feet 4 inches, of two stories, with a basement.

The basement, besides being used for storing instruments and traveling-boxes for them, is also a receptacle for the miscellaneous property of the Observatory. In any case, the main floor should be removed from the surface of the soil by having a cellar under the building.

The basement contains—

1. Storerooms.
2. Galvanic-battery rooms.
3. Boiler-rooms. (It remains, however, for future consideration whether the boiler had better be inside the building or apart from it.)
4. Coal-rooms. (It may be better to have a separate vaulted cellar for coal outside the main walls of the building.)
5. Long room, for optical experiments.

The ground floor contains—

1. The business office of the Superintendent.
2. Visitors' room.
3. Office-room for clerk of the Observatory.
4. Watchmen's room.
5. Fire-proof record-room, for computations, manuscripts, &c.
6. Instrument-maker's room, repair-shop, &c.
7. Room for the chronometers of the Navy.
8. Office-room for officers of the Navy having charge of the chronometers.
9. Clock-room for astronomical clocks.
10. Room for measuring-engine now used in measures of the transit-of-Venus photographs.

The second floor contains—

1. Photographic rooms.
2. Offices for five professors.

3. Computing-rooms for three assistant astronomers and four computers.

This main building is surmounted by three domes.

Dome C (see plan) is to cover the 9-inch equatorial now at the Observatory.

Dome B is to cover one of the 5-inch transit-of-Venus equatorials, now mounted in a wooden house in the Superintendent's garden.

Dome A is to cover the present comet-seeker of the observatory, now without any special protection.

On each side of the main building, and on the level of the ground floor, are two transit-rooms, 30 by 40 feet. One is to cover the present transit-circle; the other for the present transit and mural circle. It is hoped, however, in the future, to replace the mural circle by a more modern instrument.

These rooms are to be separated from the main building by the halls or vestibules, for isolation, each 15 feet long by 8 feet wide.

The vestibules or halls connecting the main building with the out ones, might have been compressed, but in order to avoid disturbance of atmosphere, it was thought best practically to isolate them.

Back of the main building is a library-room 36½ by 50 feet. Back of this is a room to cover the present prime vertical transit instrument. Back of this, is the dome to cover the 26-inch equatorial, with computing-rooms for one professor and one assistant.

G.

UNITED STATES NAVAL OBSERVATORY.—SPECIFICATION OF MANNER OF CONSTRUCTION.

Position.

It is assumed in the estimate that the ground selected will be a plateau of sufficient area, and that the floor of the basement story will be nine feet below the natural surface. This gives the first item "excavation."

Materials.

The walls of the basement story to be of rubble-stone masonry, the exterior wall to be faced with brick on the outside from the bottom of the area-way, and the floor to be of concrete.

Above the floor of the first story, the eastern and western transit-rooms, the prime vertical transit-room, the rooms for the 26-inch and 9.6-inch equatorials, and the domes to the east and west of the latter, to be constructed entirely of iron, covered outside with galvanized sheet-iron, and lined inside with tin. The northern or main portion of the building, the library and the professors' rooms, near the 26-inch equatorial, to be of brick, the walls to be built hollow.

All the floors to be of brick arches, supported by iron beams of suitable dimensions.

These arches to be covered with concrete, and the tile or pine flooring to be laid in the usual manner.

The steps entering the northern or main portion of the building, and all the sills of windows through masonry walls to be of cut stone.

The piers for the instruments to be of dark Croton brick or similar material.

All the roof coverings to be of galvanized sheet-iron.

Interior walls to be plastered; the plastering for the ceilings is omitted in the estimate.

Vertical dimensions.

Basement story to be 12 feet in the clear.

First story of the northern or main portion of the building to be 16 eet in the clear; the floor of this story, which is common to the whole structure, is taken at 4 feet above the natural surface of ground.

The second story to be 14 feet in the clear, and above this story an air space 6 feet in height is estimated for.

The eastern and western transit-rooms each to have a height of 24 feet from floor to eaves.

The library, which is to have the book-cases and shelves placed as shown in plan, and two galleries above its floor, communicated with by stairways at each end of the room, is to be 23 feet from floor to eaves.

The prime vertical transit-room to be 16 feet from floor to eaves.

The professors' rooms near the 26-inch equatorial to be 16 feet in the clear.

The center of hemispherical dome of the 26-inch equatorial is taken at such a height that a line drawn from it tangent to the dome of the 9.6-inch equatorial north of it will make an angle of 12° with the horizon.

The piers for the instruments are only estimated for up to the floors of the rooms in which the instruments are to be mounted, and the apparatus for moving the shutters from over the slits in the roofs of the transit-rooms and domes of equatorials, and for turning the domes themselves, are not estimated for.

Estimated weight of the dome of 26-inch equatorial, 55,630 pounds.

Estimated weight of the dome of 9.6-inch equatorial, 11,400 pounds.

It is assumed that the boiler for heating purposes will be placed in a house 100 feet distant from the Observatory buildings, but if it be placed in the building as shown on the plan, $2,000 must be deducted from the estimate.

Estimate of the cost of a new building for the United States Naval Observatory.

Excavation, 11,018 cubic yards, at $1	$11,018 00
Rubble-stone masonry, 78,189 cubic feet, at 20 cents	15,637 80
Cut-stone masonry, 1,140 cubic feet, at 80 cents	912 00
Front brick, 18,720 cubic feet, at 90 cent	16,848 00
Common brick, 99,896 cubic feet, at $12 per thousand	25,173 79
Dark Croton brick, 10,499 cubic feet, at $17 per thousand	3,748 14
Concrete flooring, basement and area, 24,670 square feet, at 18 cents	4,440 60
Concrete tiling, for halls, 4,330 square feet, at 25 cents	1,082 75
Concrete over floor-arches, 7,937 cubic feet, at 30 cents	2,381 10
Plastering, 5,305 square yards, at 30 cents	1,591 50
Georgia pine flooring, for rooms, 16,915 square feet, at 6 cents	1,014 90
Wrought-iron floor-beams, ties, wall-plates, railings about area and stoops, and wrought iron, cast iron, galvanized sheet-iron, and tin used in the construction of rooms for the equatorials and transits, and interior of library and roofs, 886,682 pounds, at 5 cents	44,334 10
Cast-iron stairways, 43,810 pounds, at 7 cents	3,066 70
Piazza, 426 linear feet, at $8	3,408 00
1 turret light and ventilator, for library, at $800	800 00
1 skylight, hall to library, at $300	300 00
5 windows, sashes and frames iron, at $150	750 00

134 windows, sashes and frames iron, at $50	$6,700 00
2 windows, sashes and frames iron, at $40	80 00
85 windows, sashes and frames iron, at $35	2,975 00
1 double door, iron paneled, at $150	150 00
2 double doors, iron paneled, at $120	240 00
4 single doors, iron paneled, at $60	240 00
1 single door, iron paneled, at $50	50 00
82 single doors, iron paneled, at $40	3,280 00
Steam-heating, automatic low pressure, $3,575	3,575 00
Gas-fitting	1,150 00
Plumbing	1,000 00
Painting	2,500 00
Window-glass and glazing	1,917 00
Gas-fixtures	1,000 00
Total	161,464 38

H.

UNITED STATES NAVAL OBSERVATORY,
Washington, October 11, 1878.

SIR: In response to the request contained in the letter of the commission, dated the 4th ultimo, I have the honor to say, that I deem the buildings enumerated below, with estimated cost necessary for their erection, as proper and useful adjuncts to a naval observatory situated in the vicinity of Washington.

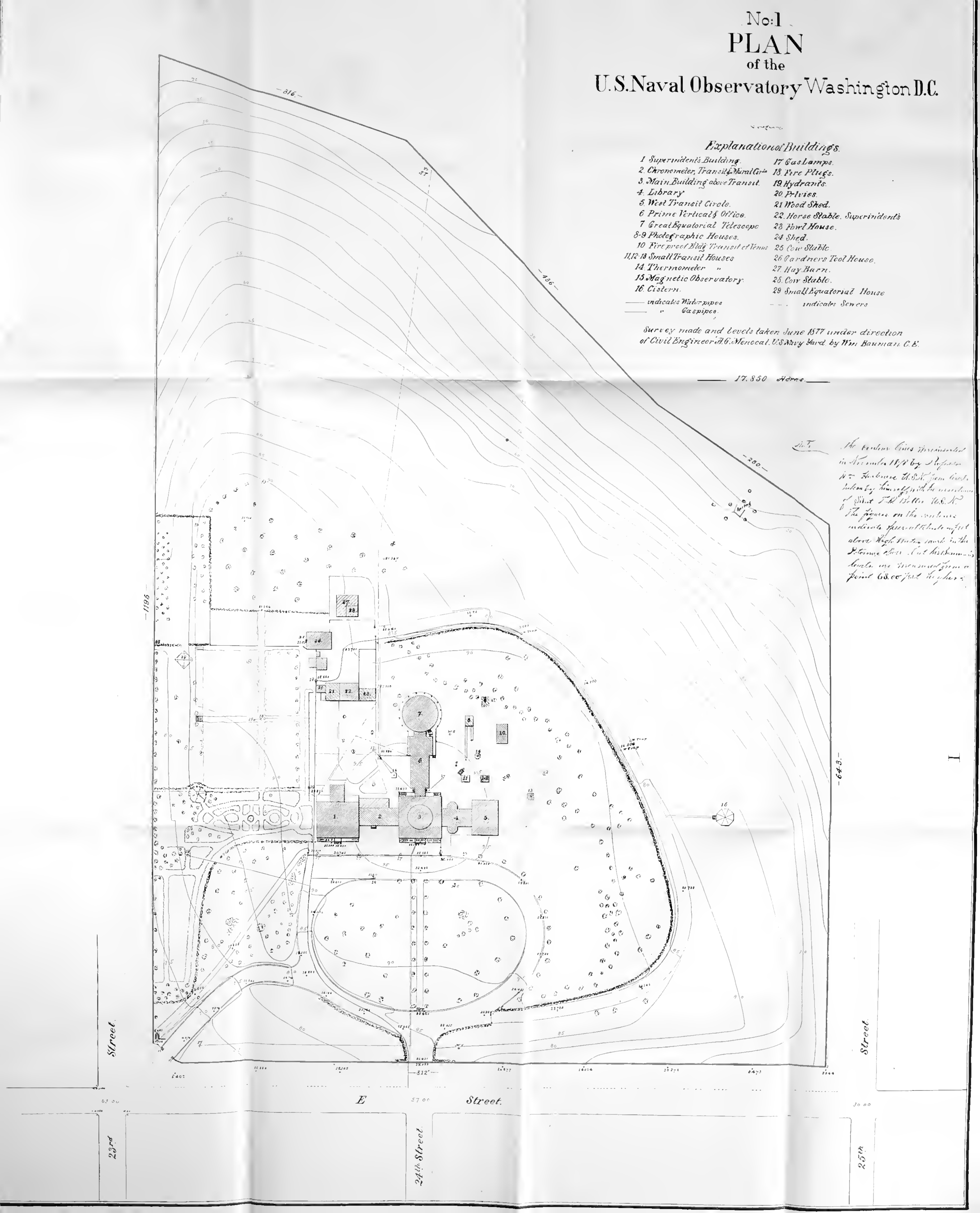
1	One house for Superintendent	$13,000
6	Six houses for professors, at $7,000	42,000
3	Three houses for assistant astronomers, at $4,500	13,500
1	One house for secretary	4,000
1	One house for superintendent of grounds	2,500
1	One house for instrument-maker	2,500
4	Four houses for watchmen, at $2,000	8,000
17		85,500

From which it will be seen that seventeen houses will be required, at an aggregate cost of $85,500.

Very respectfully, your obedient servant,

JOHN RODGERS,
Rear-Admiral, Superintendent.

Rear-Admiral DANIEL AMMEN, U. S. N.,
Chairman of Commission relating to cost of removal of the Naval Observatory.



No: 1
PLAN
of the
U.S. Naval Observatory Washington D.C.
Explanation of Buildings.
1 Superindent's Building.
2. Chronometer, Transit & Mural Cir.
3. Main Building above Transit.
4. Library
5. West Transit Circle.
6 Prime Vertical & Office.
7 Great Equatorial Telescope
8-9 Photographic Houses.
10 Fireproof Bldg. Transit of Venus
11, 12-13 Small Transit Houses
14. Thermometer "
15. Magnetic Observatory.
16. Cistern.
17 Gas Lamps.
18. Fire Plugs.
19. Hydrants.
20. Privies.
21 Wood Shed.
22. Horse Stable. Superindent's
23 Fowl House.
24 Shed.
25 Cow Stable.
26 Gardners Tool House.
27. Hay Barn.
28. Cow Stable.
29 Small Equatorial House
indicates Water-pipes
" Gaspipes.
indicates Sewers
Survey made and levels taken June 1877 under direction of Civil Engineer A. G. Menocal. U.S. Navy Yard. by Wm Bauman. C.E.
17.850 Acres.
316.
436.
250.
643.
1195.
812.
E Street.
23rd Street.
24th Street.
25th Street.

SURVEY OF

CLIFTON

PART OF A TRACT OF LAND CALLED THE. *No. 18.*

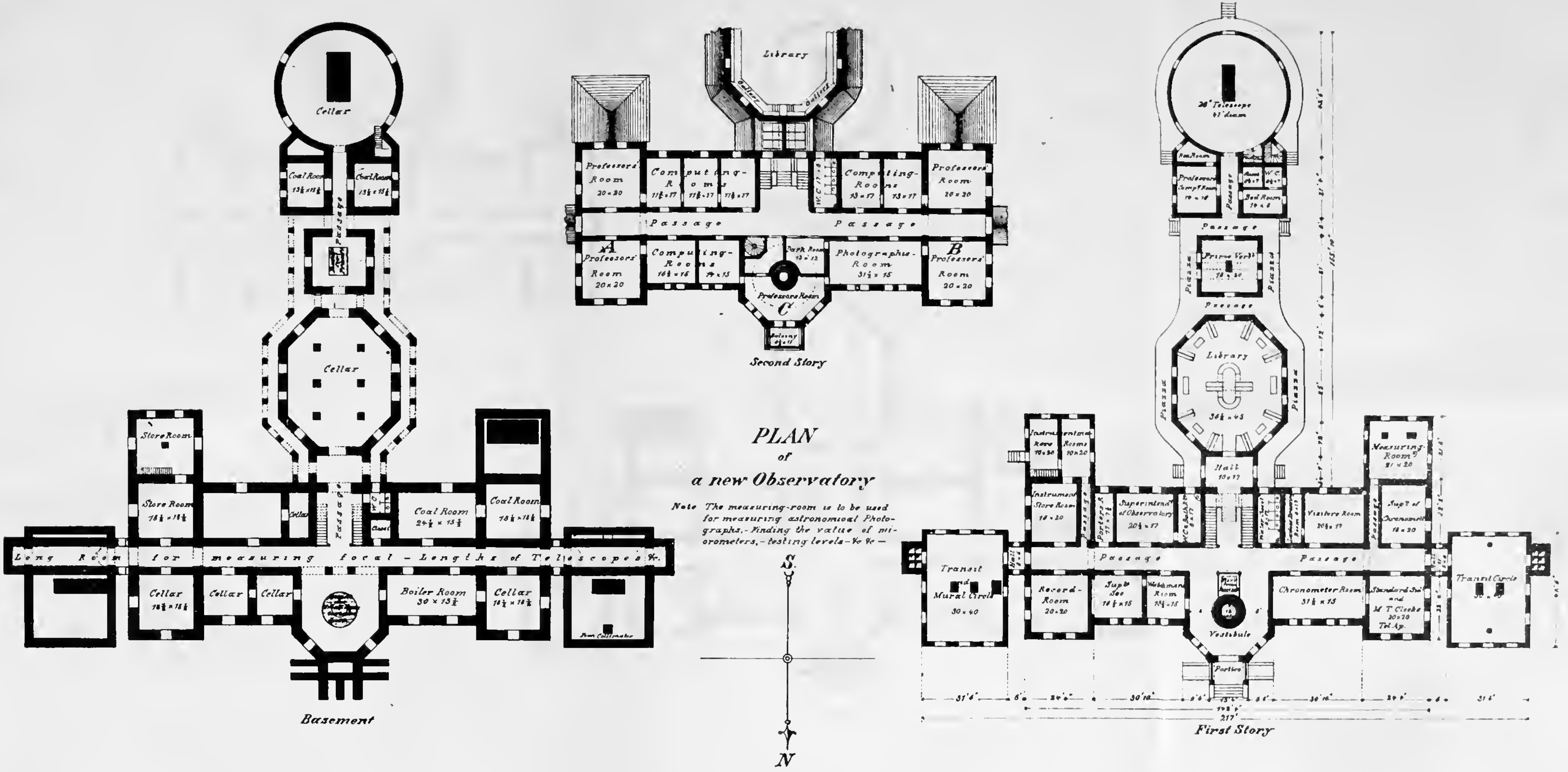
ROCK OF DUMBARTON

IN THE DISTRICT OF COLUMBIA

Owned by James Eleason.

H. W. Brown
Surveyor
November 16th 1877.

Content 41.716 As



PLAN
of
a new Observatory

Note. The measuring-room is to be used for measuring astronomical Photographs,—Finding the value of micrometers,—testing levels—&c &c—